



3D Surface Modeling Using Bentley Context Capture

Agenda

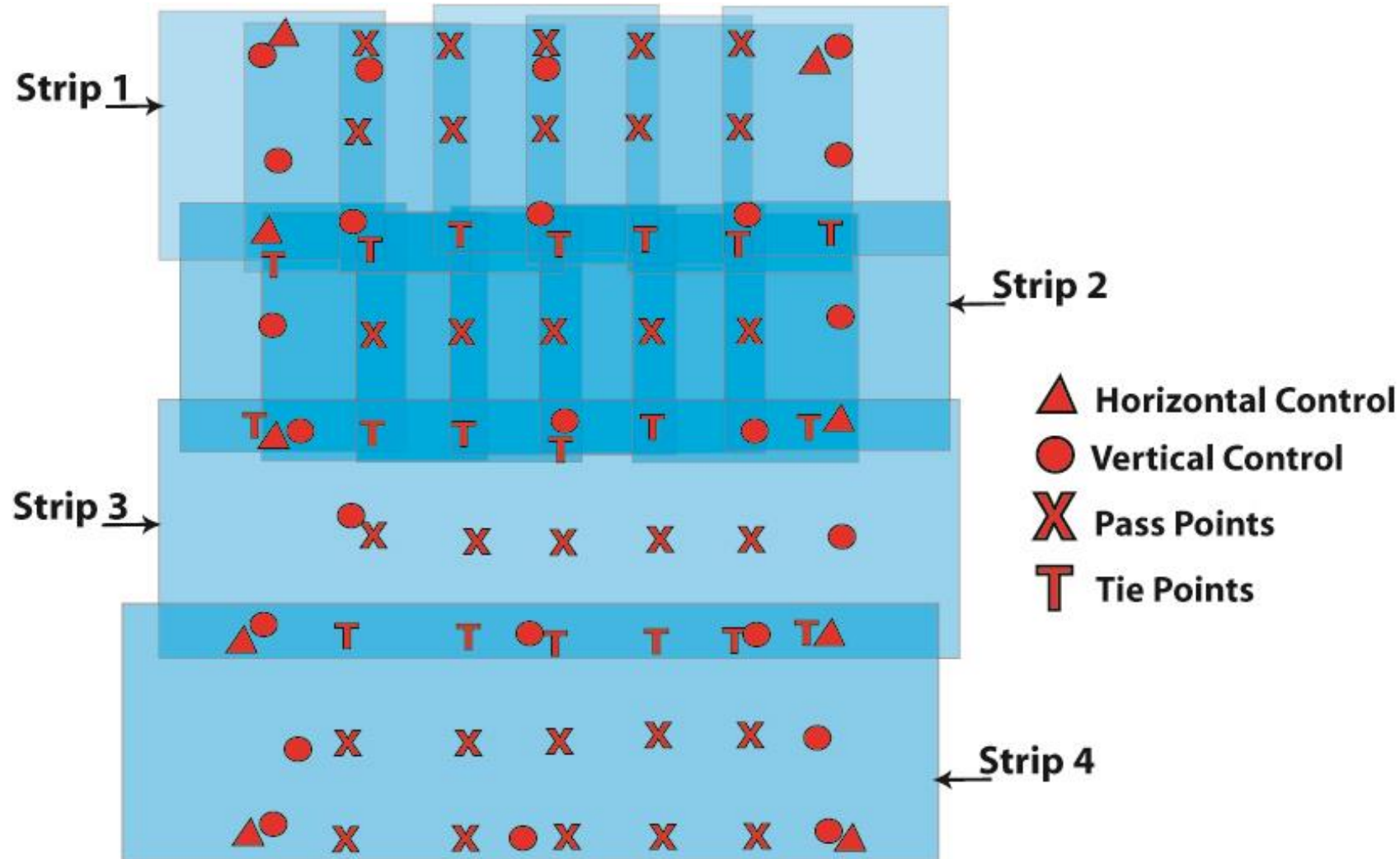
1. Multi-Ray Photogrammetry

- Brief Overview of Photogrammetry
 - Aero-triangulation
 - Self-Calibration
 - Advent of Multi-ray and Computer Vision

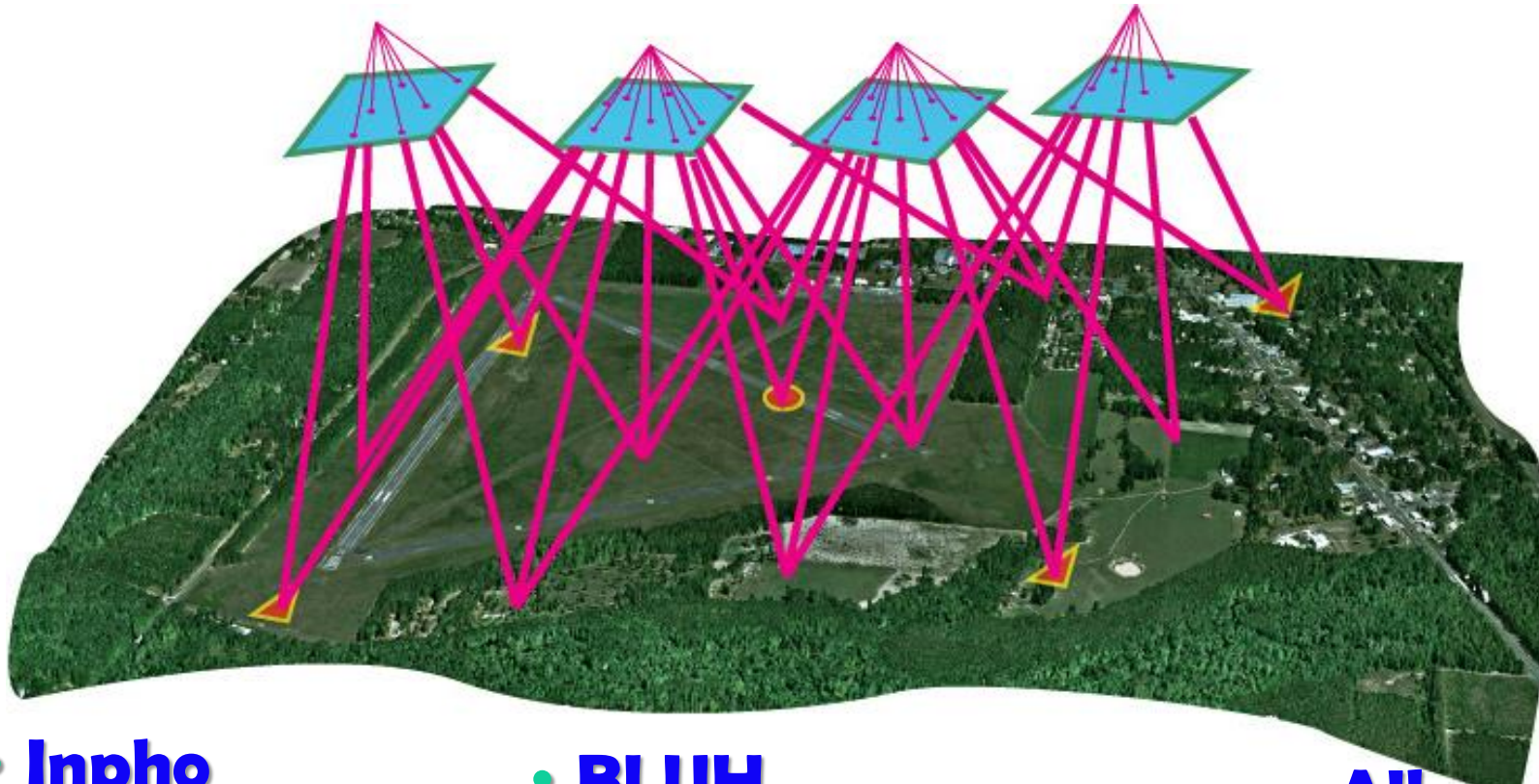
(Microsoft Research and University of Washington)

- Sensors (Camera Systems)
 - Camera Features Needed
 - Sensors (Camera Systems)
 - Sample Demo with Bentley Context Capture

A typical Aerial-Triangulation Layout



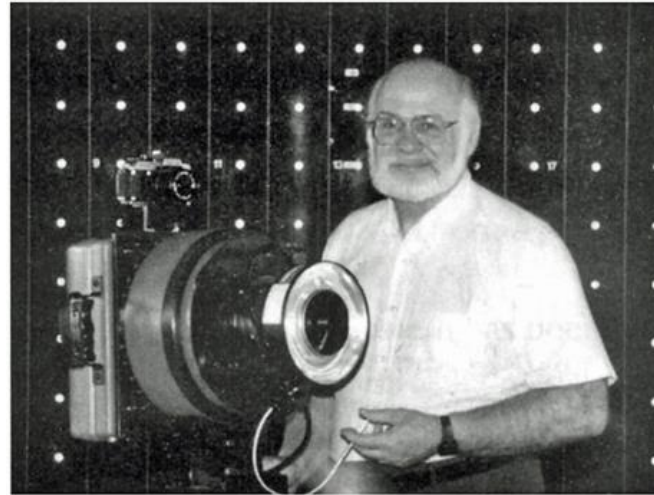
Aerial Triangulation - Bundle Adjustment



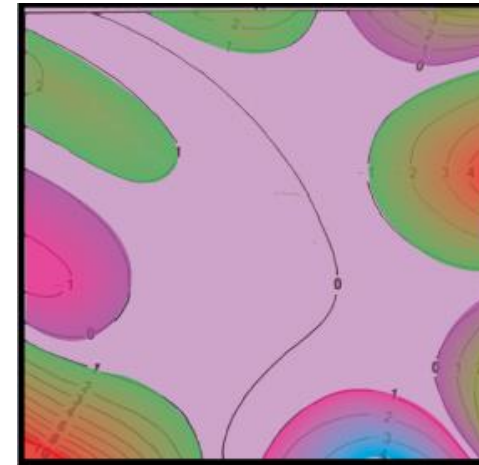
- **Inpho**
- **Aerosys**
- **Leica LPS**
- **Socet GXP**
- **BLUH**
- **BINGO**
- **Intergraph**
- **Photomod**
- **Albany**
- **JFK**
- **PC Giant**

Self-Calibration

Dr. Brown introduced Self- Calibration in the bundle adjustment.



Dr. Duane Brown
History of Photogrammetry
Center for Photogrammetric Training



Anomalous Distortion

ASPRS

Self calibration Improves:

- **the accuracy**
- **the reliability of the photogrammetric adjustment**

<http://www.geodetic.com/v-stars/what-is-photogrammetry.aspx>

Microsoft (ICE Project)

<https://www.microsoft.com/en-us/research/product/computational-photography-applications/image-composite-editor/>

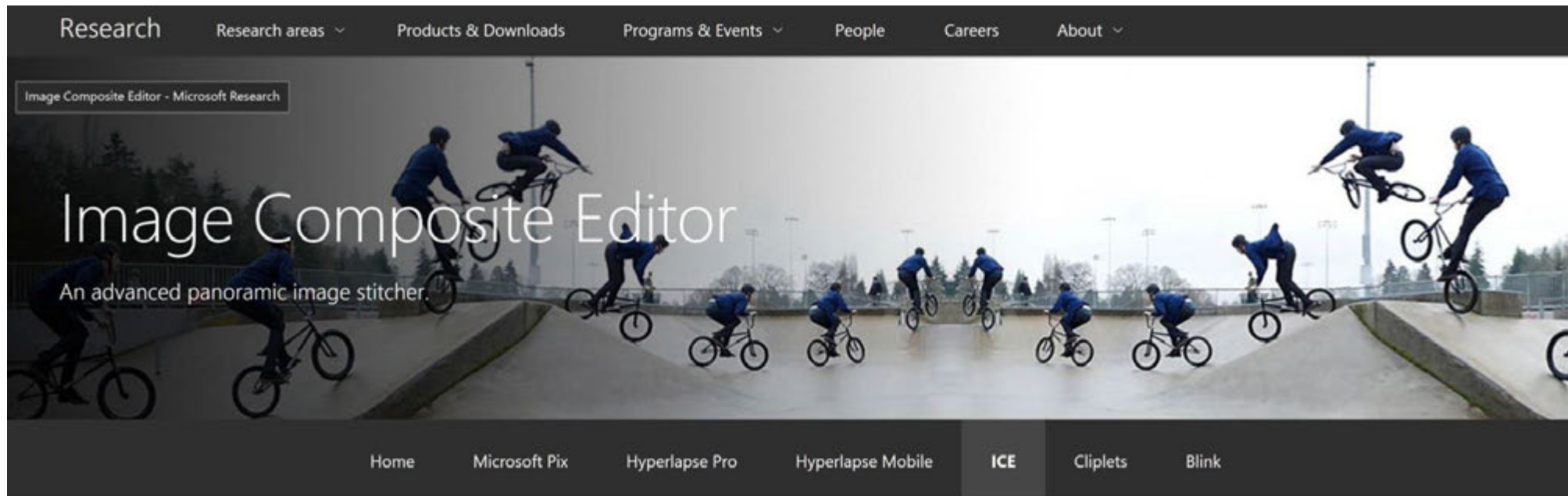
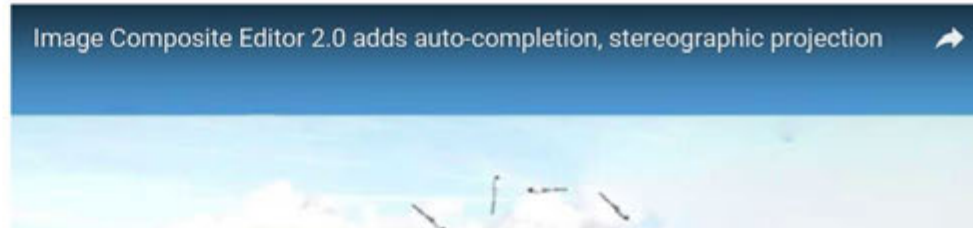
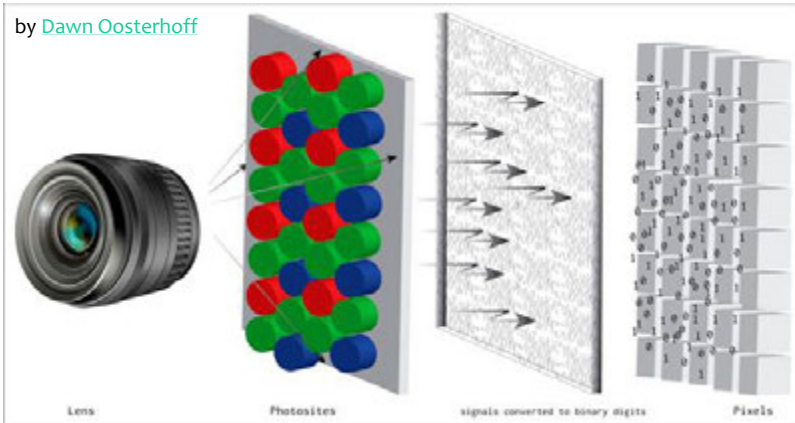


Image Composite Editor (ICE) is an advanced panoramic image stitcher created by the Microsoft Research Computational Photography Group. Given a set of overlapping photographs of a scene shot from a single camera location, the app creates high-resolution panoramas that seamlessly combine original images. ICE can also create



State of the Art Sensors



DR - brightest area and the darkest area an image sensor can process without saturation.

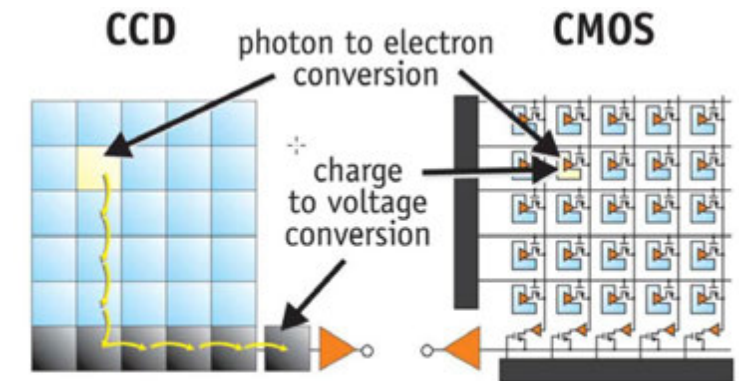
Dynamic Range (DR)

- Human eye - 90 dB
- Camera film - 80 dB
- CCD or CIS - 65 to 75 dB
- State of the art CIS - 150 dB

CCD – Couple Charged Device

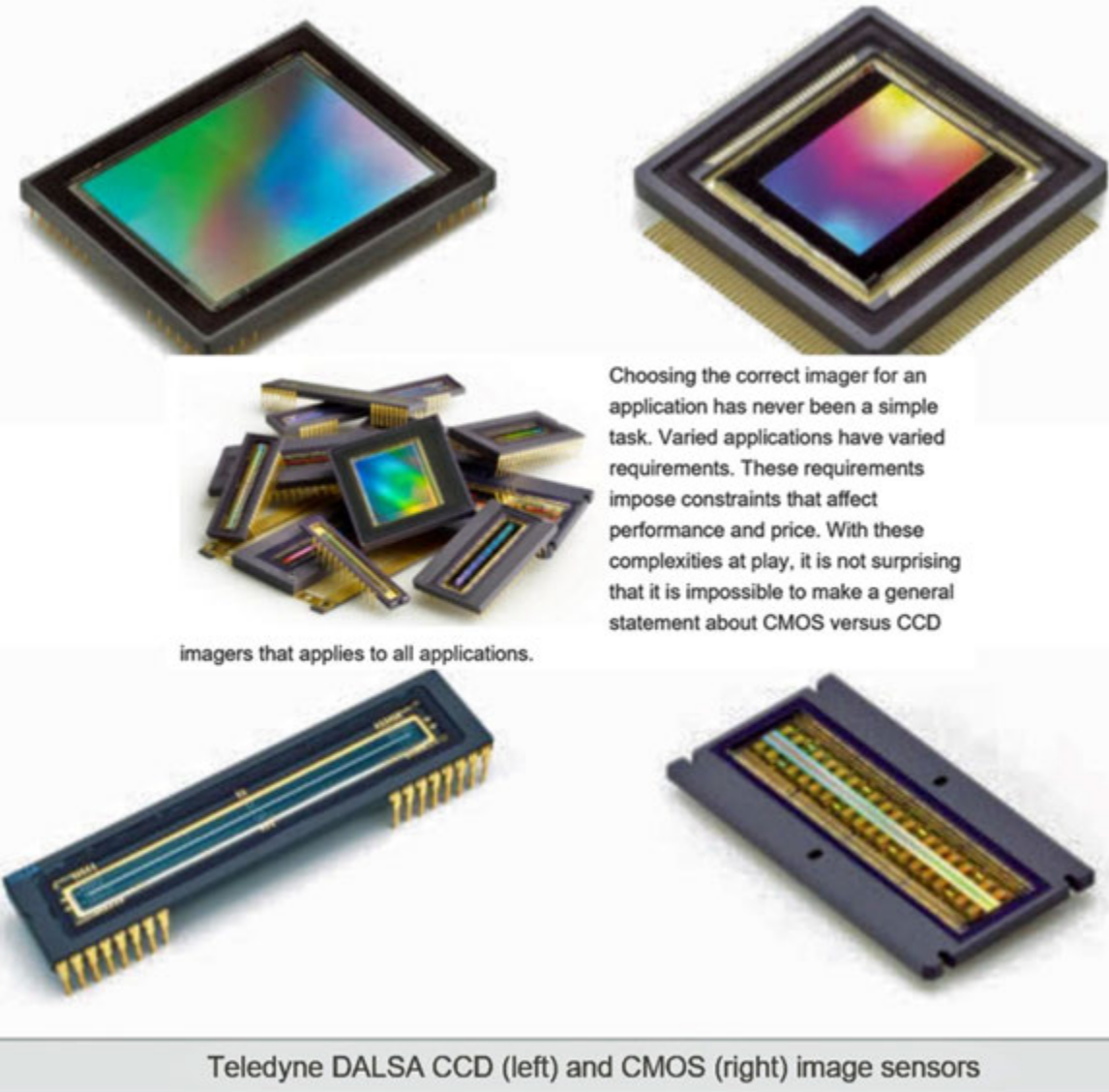
CIS – CMOS Image Sensors

CMOS – Complimentary Metal Oxide Semiconductor



CCDs move photogenerated charge from pixel to pixel and convert it to voltage at an output node. CMOS imagers convert charge to voltage inside each pixel.

CCD & CMOS Varied applications have varied requirements




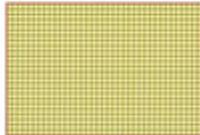
- UAS
- Close Range
- Metrology
- Forensic
- Archeology
- Environmental
- Volumetric Surveys
- Autonomous Vehicles
- Microscopy
- Photogrammetry

Is Higher Megapixel better ?

by Romanas Naryškin
Photography Life



First, let's go over the key specifications:

	36mm x 23.9mm	35.9mm x 24.0mm
Sensor Size		
Sensor Pixel Size	7.3 microns	5.6 microns
Sensor Resolution	16.2 Mp	24.3 Mp
Image Size	4928 x 3280	6015 x 4015

The benchmark is a **full-framed sensor**—a sensor with the same dimensions as a frame of 35mm film; that is, 36 × 24 mm

Nikon Df vs D610 Specification Comparison

Camera Feature	Nikon Df	Nikon D610
Sensor Resolution	16.2 Million	24.3 Million
Sensor Type	CMOS	CMOS
Sensor Size	36×23.9mm	35.9×24.0mm
Sensor Pixel Size	7.30μ	5.96μ
Low Pass Filter	Yes	Yes
Sensor Dust Reduction	Yes	Yes
Image Size	4,928 × 3,280	6,016 × 4,016
Native ISO Sensitivity	ISO 100-12,800	ISO 100-6,400
Boosted ISO Sensitivity	ISO 50, 25,600-204,800	ISO 50, 12,800-25,600
HDR Support	Yes	Yes
Exposure Bracketing	2 to 5 frames	2 to 3 frames
Built-in GPS	No	No
Wi-Fi Functionality	Eye-Fi Compatible, WU-1b	Eye-Fi Compatible, WU-1b
Battery	EN-EL14a Lithium-ion Battery	EN-EL15 Lithium-ion Battery
Battery Life	1400 shots (CIPA)	900 shots (CIPA)
Battery Charger	MH-24 Quick Charger	MH-25 Quick Charger
Weather Sealed Body	Yes	Yes
Build	Top and Rear Magnesium Alloy	Top and Rear Magnesium Alloy
USB Version	2.0	2.0
Weight (Body Only)	710g	760g
Dimensions	143.5 × 110 × 66.5mm	141 × 113 × 82mm
MSRP Price	\$2,749 (as introduced)	\$1,999 (as introduced)

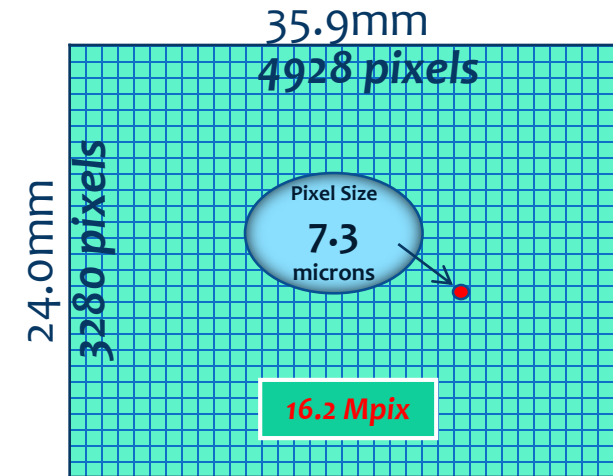
Does Size Matter? New Image Sensors Bring More Pixels, More Problems by Dawn Oosterhoff

Values to know !

Nikon D

Image Size 4928 x 3280
Sensor Pixel Size 7.3 microns
Sensor Resolution 16.2 Mp
Sensor Size 35.9mm x 24.0mm

Image Resolution = $4928 \times 3280 = 16.164 \text{ Mpix}$



Compute:

Sensor Resolution
Given Sensor Size &
Pixel Size = $35.9\text{mm} \times 1000 = 35900 \text{ microns}$ $35900/7.3 = 4917.80$ 4917.8×3287.67
 $24.0\text{mm} \times 1000 = 24000 \text{ microns}$ $24000/7.3 = 3287.67$ = 16.168 M pix

Compute:

Sensor Size
Given Image Size &
Pixel Size = $4928 \times 7.3 = 35974.4 \text{ microns} = 35974.4/1000 = 35.9 \text{ mm}$
 $3280 \times 7.3 = 23944 \text{ microns} = 23944/1000 = 23.9 \text{ mm}$

Compute:

Sensor Pixel Size
Given Image Size &
Sensor Size = $35.9 \times 1000 = 35900 \text{ microns} = 35900/4928 = 7.285 \text{ microns}$
 $24.0 \times 1000 = 24000 \text{ microns} = 24000/3280 = 7.317 \text{ microns}$

Avg. Sensor Pixel Size = 7.3 microns

Multi-ray Photogrammetry

Multi-ray Photogrammetry

- Multi-ray photogrammetry is not exactly a new technology, rather a specific flight pattern with a very high forward overlap (80 percent, even 90 percent) and an increased sidelap (up to 60 percent). The result is considerable redundancy, critical for robust automated matching. One pixel on the ground is visible in up to 15 images
- Multi-ray photogrammetry has created a significant change in photogrammetry with the advent of the digital camera and a fully digital work flow.

“Photogrammetry versus Lidar: Clearing the Air”

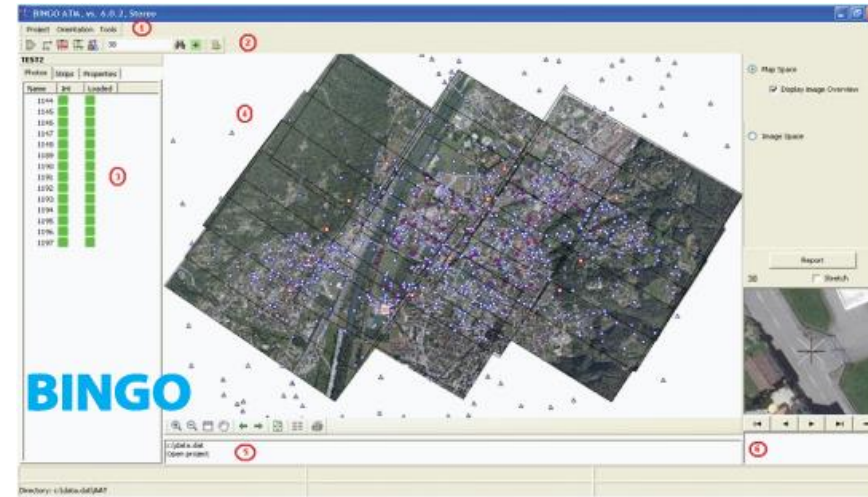
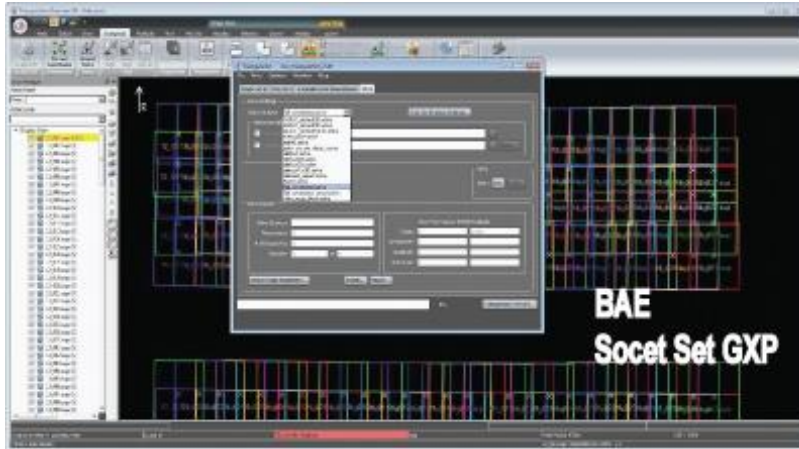
Alexander Wiechert is general manager at Vexcel Imaging GmbH, a Microsoft company in Austria. He holds degrees in Aerospace and Aeronautics and in Business Administration.

Dr. Michael Gruber is chief scientist at Vexcel Imaging GmbH.

Professional Surveyor Magazine



Current Softcopy Photogrammetric Systems



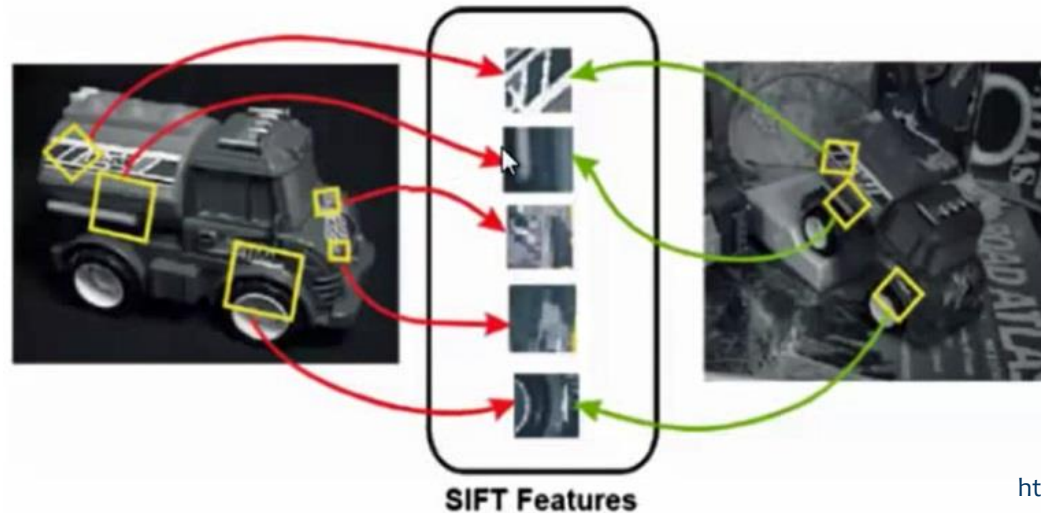
Modern Typical Methods – fast and accurate image matching

- **RANSAC** method find epipolar geometry
- Efficient and fast detection algorithm
- User defines number of points per image and matching method
- Both Matching method are used default by BINGO Dr. Kruck & Co. GbR

Random Sample Consensus (RANSAC); Fischler and Bolles, 1987)

SIFT

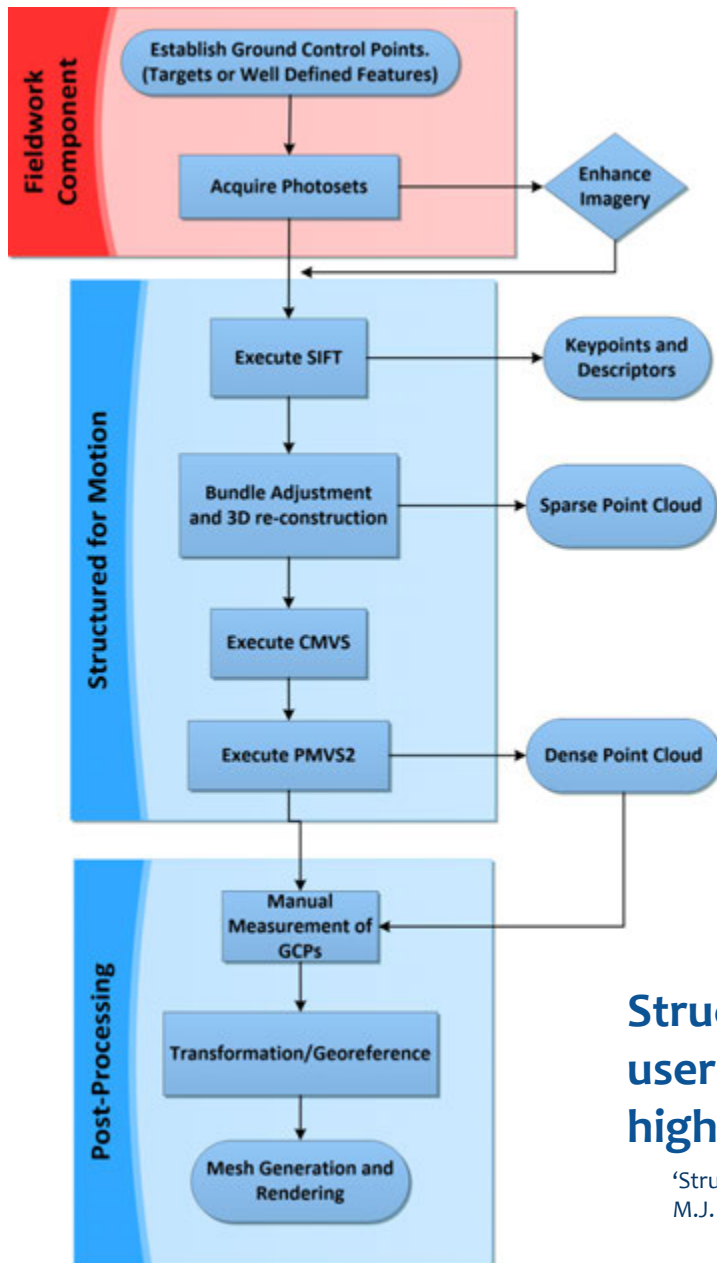
Scale-Invariant Feature Transform (or SIFT) is an algorithm in computer vision to detect and describe local features in images. The algorithm was published by David Lowe in 1999.



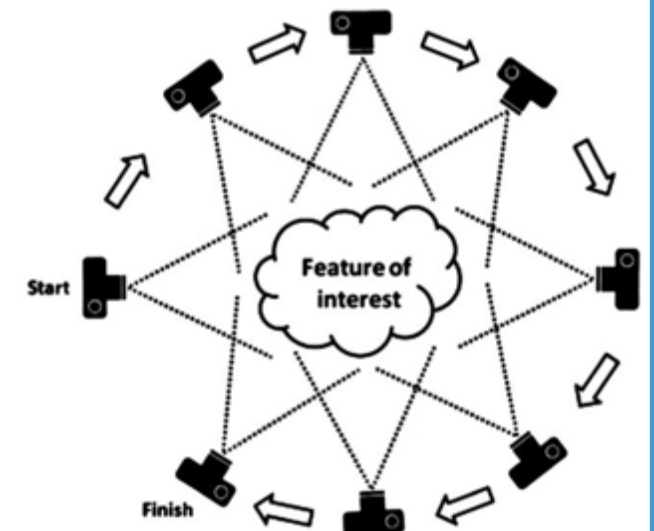
<https://www.youtube.com/watch?v=NPcMS49V5hg>

Applications include object recognition, robotic mapping and navigation, image stitching, 3D modeling, gesture recognition, video tracking, individual identification of wildlife and match moving

From Photo to Point Cloud Structured from Motion (SfM) Workflow



- Pix 4D Mapper
- Agisoft
- 3D Correlator
- Bentley “Context Capture”
- Umapv
- Geoverse
- Leica tridicon
- Trimble
- Topcon



Structure from Motion (SfM) revolutionary, low-cost, user-friendly photogrammetric technique for obtaining high-resolution datasets at a range of scales.

‘Structure-from-Motion’ photogrammetry: A low-cost, effective tool for geoscience applications
M.J. Westoby a, J. Brasington b, N.F. Glasser a, M.J. Hambrey a, J.M. Reynolds

Agisoft (SfM) App using Digital Metric Sensor Images

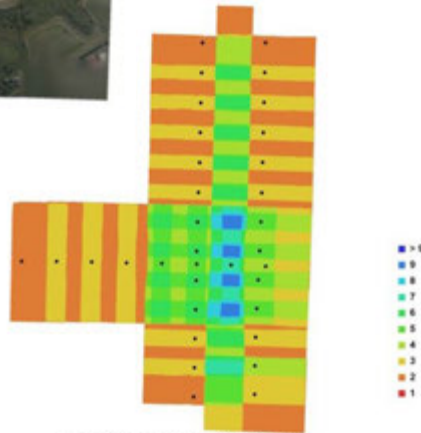


Fig. 1. Camera locations and image overlap.

Number of images: 35 Camera stations: 35
 Flying altitude: 725.928 m Tie-points: 6932
 Ground resolution: 0.07773 m/pix Projections: 23380
 Coverage area: 3.63716 sq km Error: 0.963875 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
RCD30 (53 mm)	9000 x 6732	53 mm	unknown	No

Table 1. Cameras.

Ground Control Points



Fig. 3. GCP locations.

Label	X error (m)	Y error (m)	Z error (m)	Error (m)	Projections	Error (pix)
101	-0.005215	0.007036	0.023993	0.025541	2	0.007865
102	0.005356	-0.005063	-0.003560	0.008185	4	0.023982
103	-0.001177	0.000888	-0.000185	0.001486	3	0.028794
104	0.002585	0.005624	-0.005179	0.008064	3	0.021891
105	0.008272	-0.007236	-0.009041	0.013169	2	0.009664
106	-0.017874	-0.004956	-0.005538	0.019357	4	0.057907
107	0.033101	0.000484	0.002621	0.033208	7	0.088519
108	-0.011591	0.011457	0.002533	0.016493	3	0.071241
109	-0.001159	-0.005028	0.008230	0.009714	2	0.002236
110	-0.000629	0.001294	-0.004126	0.004369	2	0.001658

Camera Calibration

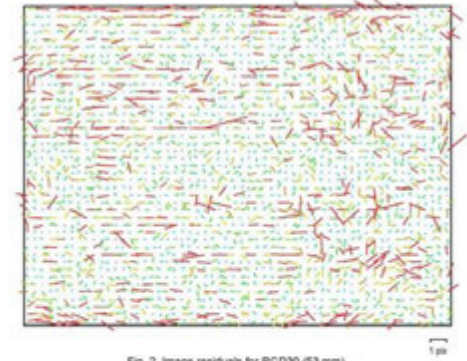


Fig. 2. Image residuals for RCD30 (53 mm).

RCD30 (53 mm)

Type: Frame K1: 0.000734446
 Fx: 8799.3 K2: -0.00802241
 Fy: 8797.38 K3: 0.0120846
 Cx: 4551.93 K4: 0
 Cy: 3373.86 P1: 0.000309445
 Skew: -0.570266 P2: 0.000681187

Digital Elevation Model

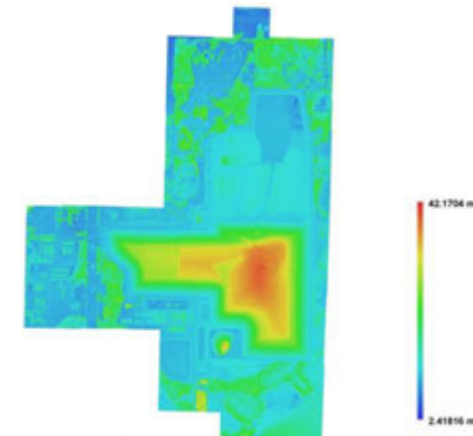
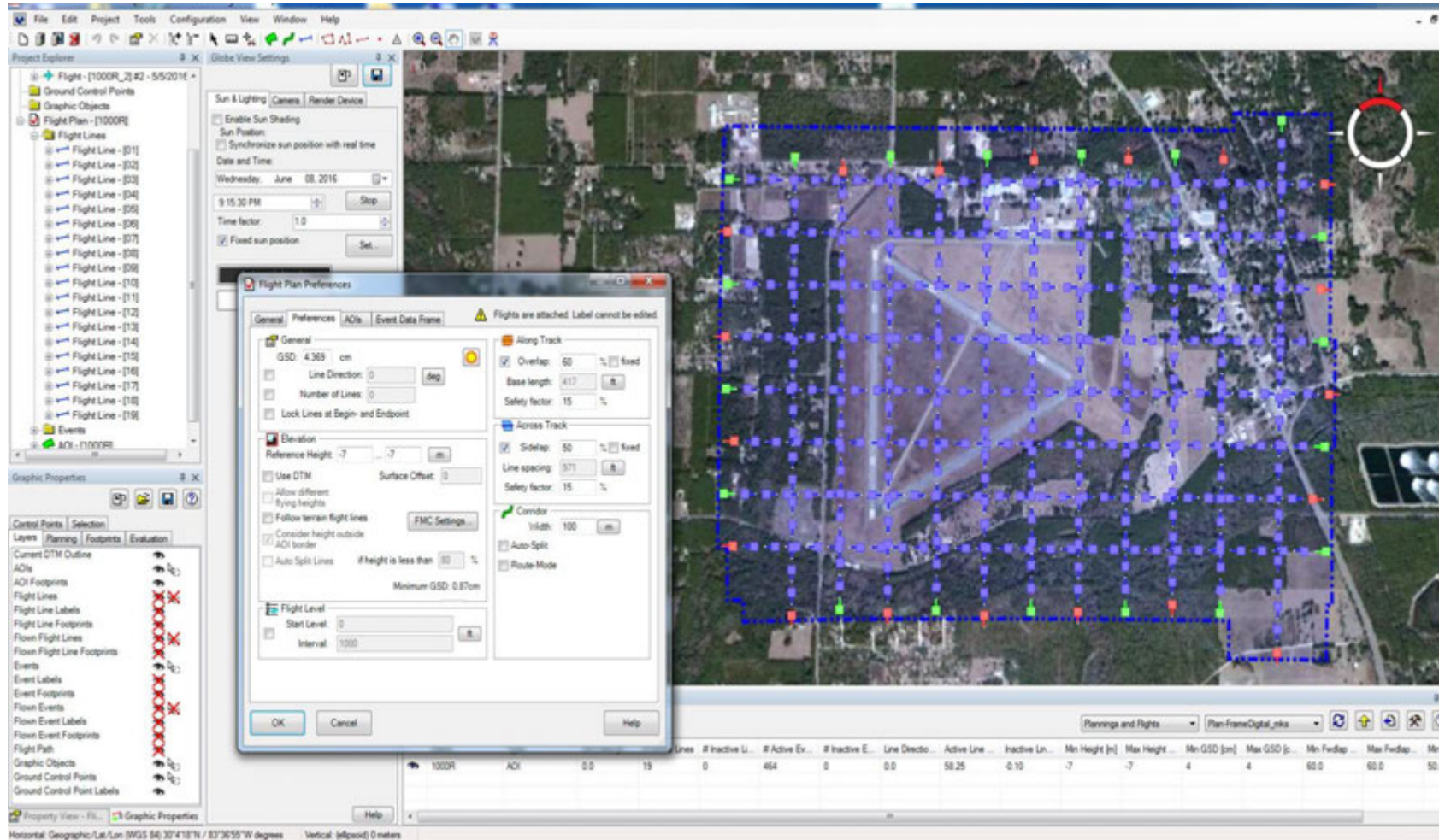


Fig. 4. Reconstructed digital elevation model.

Resolution: 0.15546 m/pix
 Point density: 41.3774 points per sq m

FDOT Flight Planning – Leica Mission Pro



IMU/GPS boresight and Multi-ray Photogrammetry testing

Perry Airport FDOT boresight

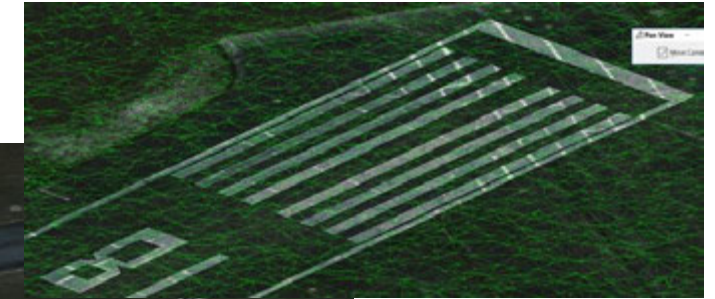
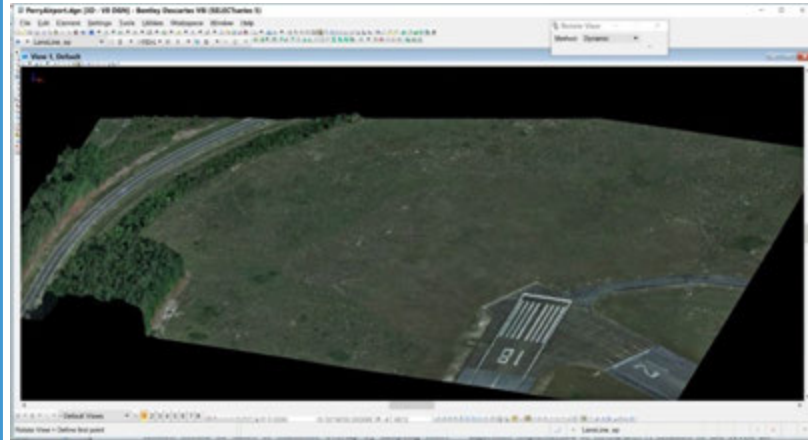


Perry Airport 2.5 D surface - Over 300 images Bundle Adjusted with Bentley's **Context Capture**

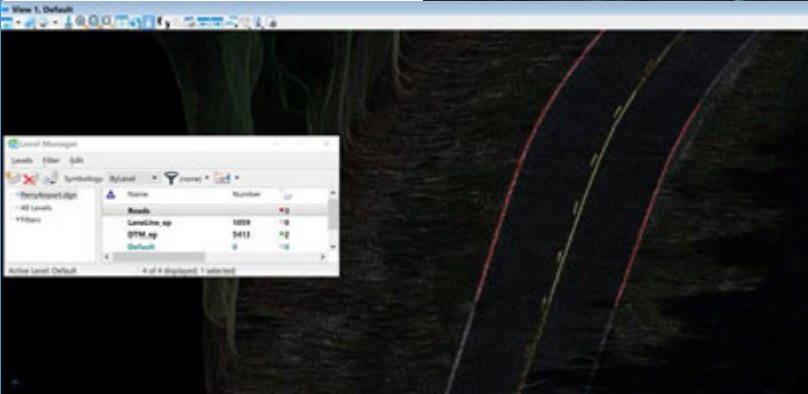
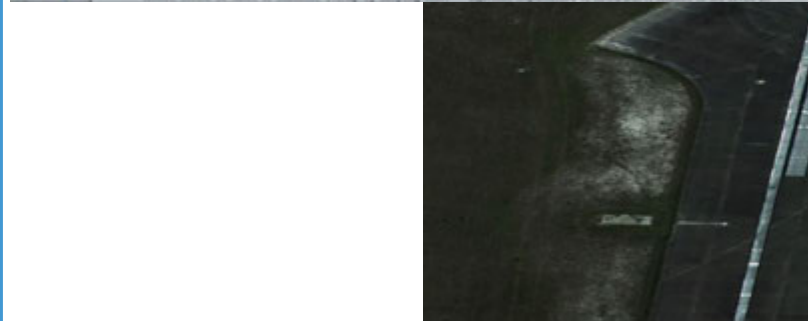
Imagery from FDOT-SMO - Zeiss DMC (2003) digital camera equipped with an upgraded CCD sensor

2.5D surface Generated using Bentley's Context Capture

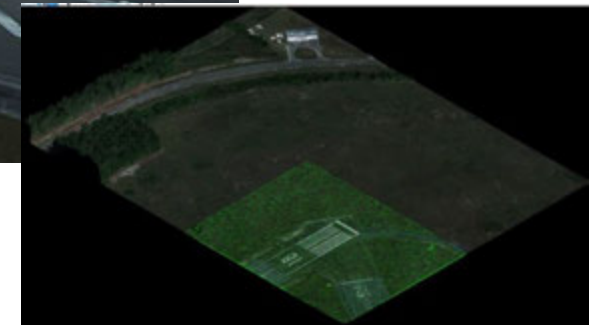
Perry Airport FDOT boresight Point Cloud in Microstation Descartes



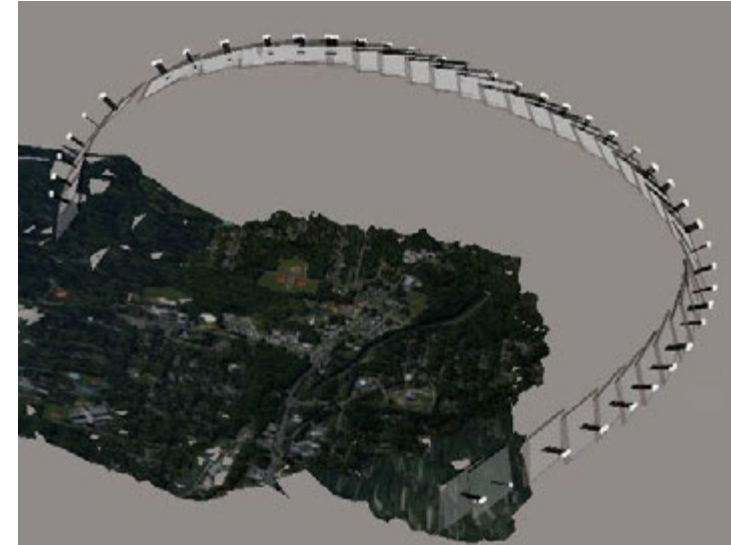
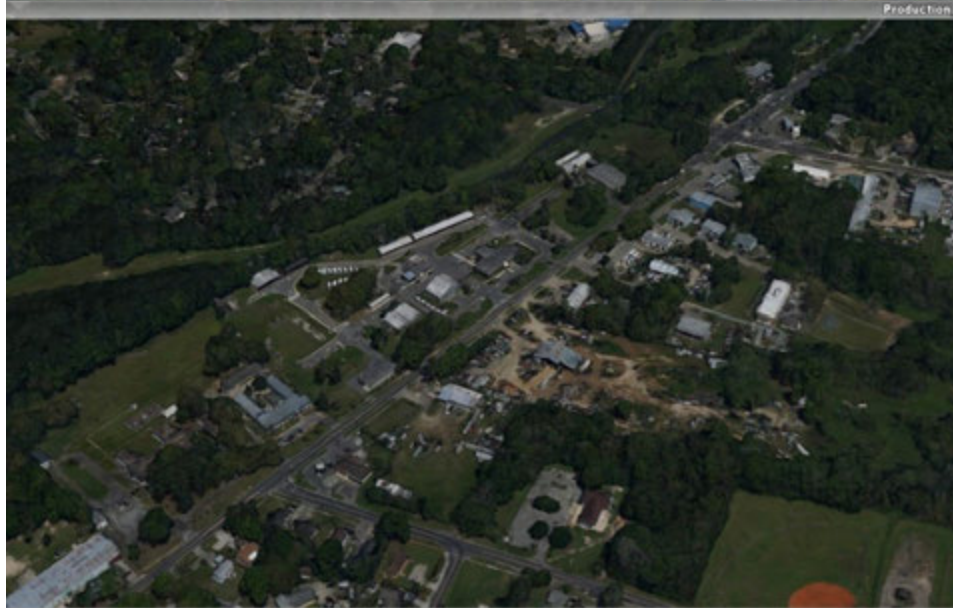
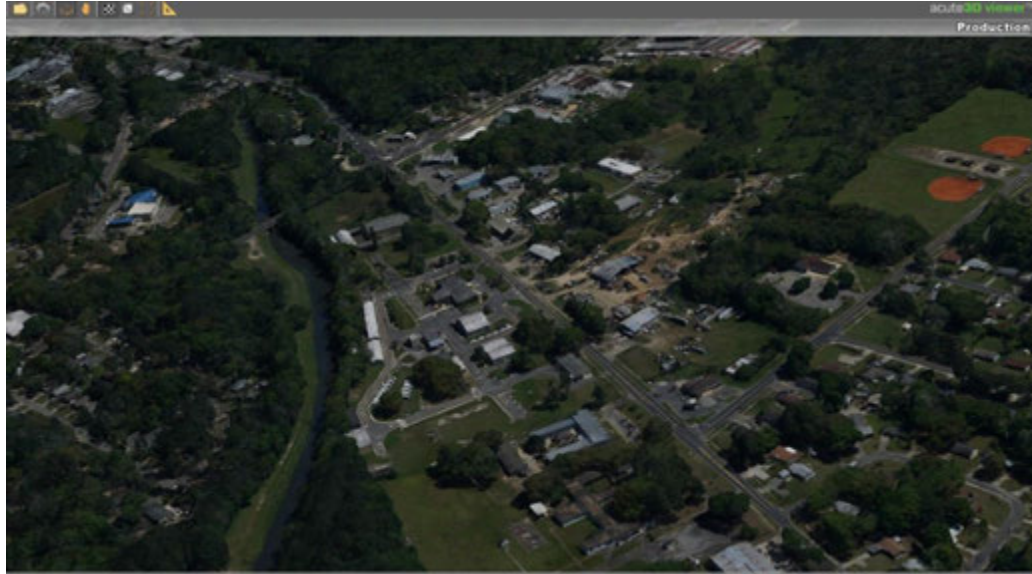
Close-up TIN



Digitized line features



TERL Site- Tallahassee

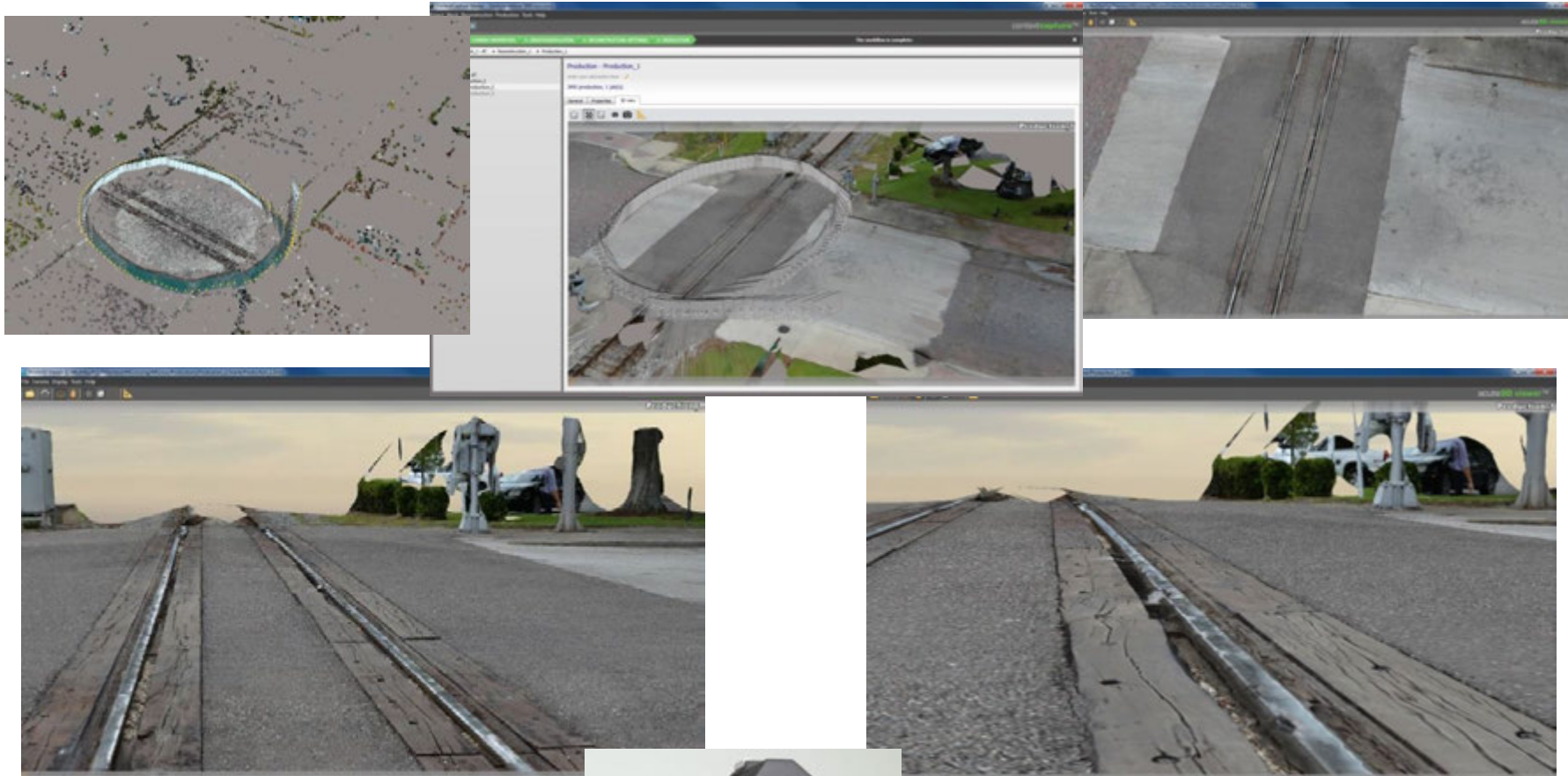


Sony A6000



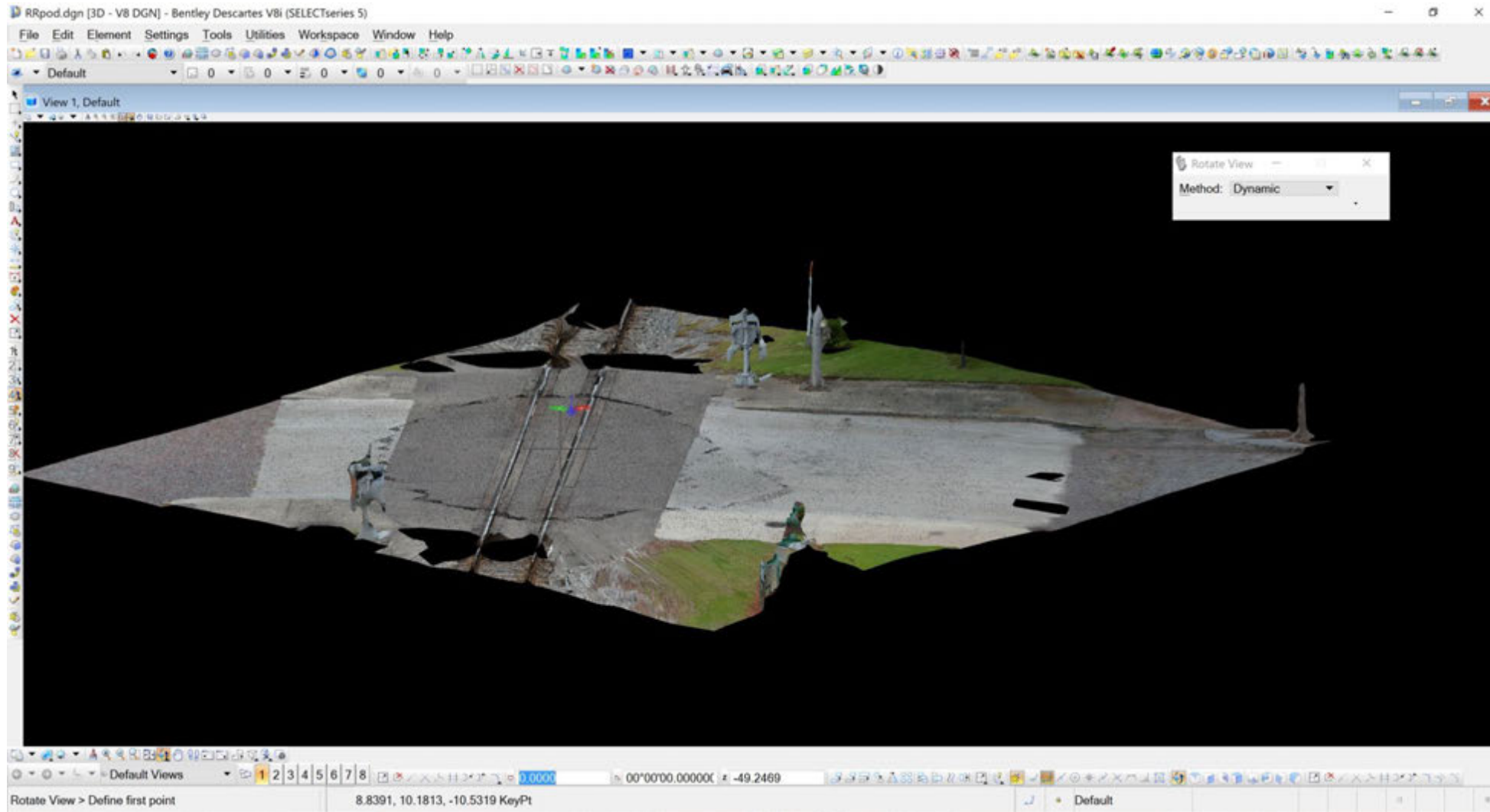
Focal Length (f)	50
Pixel Size (Ps)	3.9
Swath Along	4000
Swath Across	6026

Inspections w/ Nikon Df



Focal Length (f) mm	50
Pixel Size (Ps) microns	5.2
Swath Along -pixels	4596
Swath Across -pixels	6923

Exported as POD file to Bentley Descartes

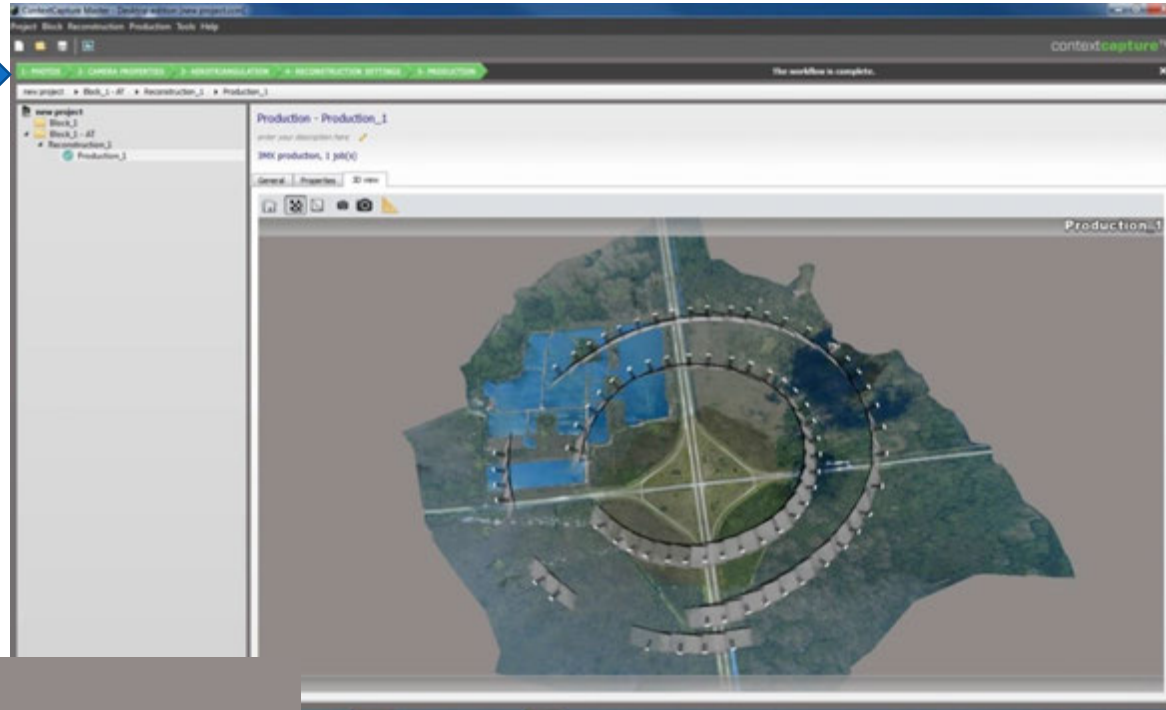


HWY Intersection w/ Nikon Df

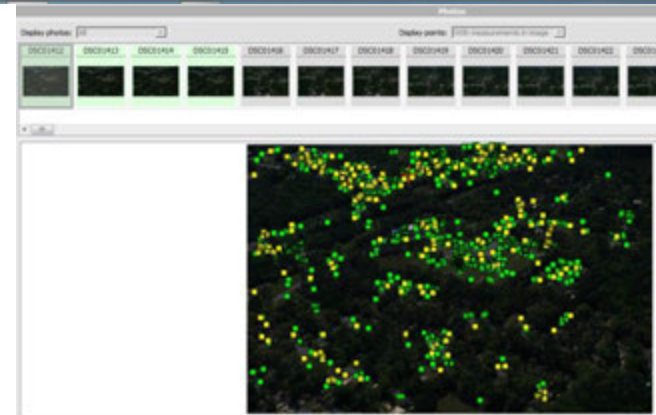
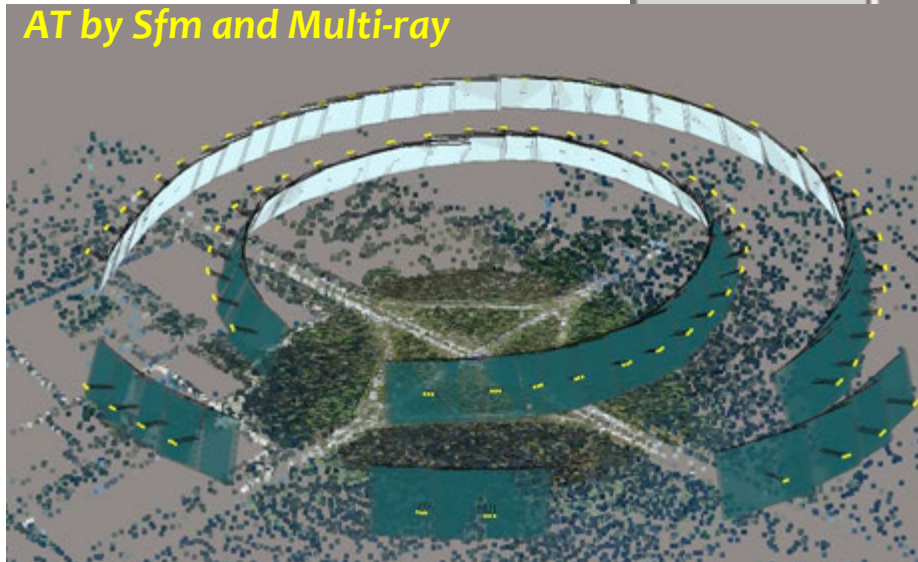
Context Capture Workflow



Nikon Df

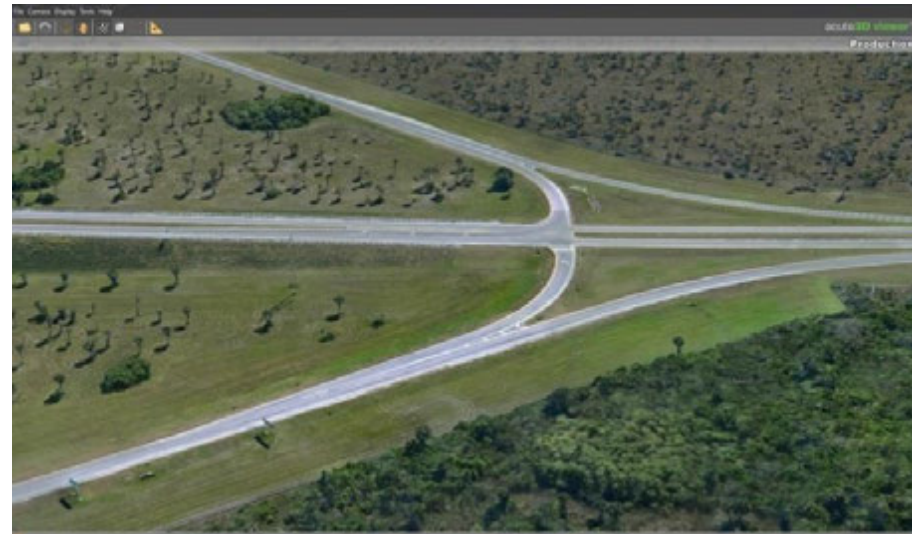
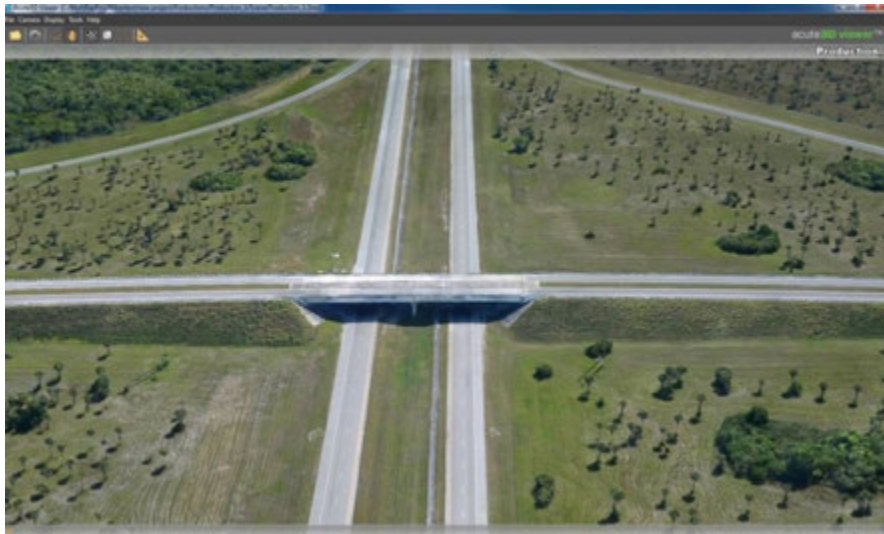


AT by SfM and Multi-ray



Tie or Key Points

Final Textured 3D Surface



Photogrammetric Capture - The '3 x 3' Rules

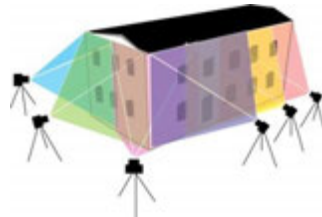
3.1 THE GEOMETRIC RULES

1.1 – CONTROL

- Measure long distances between well-defined points
- Define a minimum of one vertical distance (either using plumb line or vertical features on the object) and one horizontal.
- Do this on all sides of the object for control
- Ideally, establish a network of 3D coordinated targets or points from a loop traverse around the object.

1.2 - STEREO PHOTOCOVERT

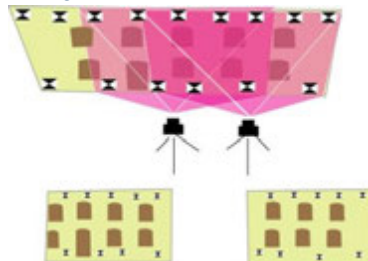
- Take a 'ring' of pictures around the subject with overlap of at least 60%. Some software needs 80% overlap.
- Take shots from a height about half way up the subject if possible.
- Include the context or setting ground line, skyline, etc.
- At each corner of the subject take a photo covering the two adjacent sides.
- Include the top, if possible (Aerial Obliques).
- No image should lack overlap.
- Add orthogonal, full facade shots for an overview and rectification.



1.3- DETAIL STEREO PHOTOCOVERT

Stereo-pairs should be taken:

- Normal case (base-distance-ratio 1:4 to 1:15), and/or
- Convergent case (base-distance-ratio 1:1 to 1:15).
- Close-up 'square on' stereo-pairs for detail
- Measure control distances within overlaps
- Check photography overlaps. If in doubt, add more shots
- Measure distances for any potentially obscured areas.
- Make sure enough control (at least 4 points is visible in the stereo image area).



3.2 - THE CAMERA RULES

2.1 - CAMERA PROPERTIES

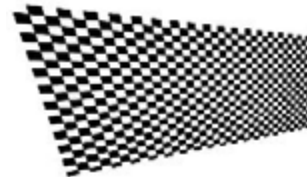
- Fixed optics if possible. No zooming! Fully zoom-out. Do not use shift optics. Disable auto-focus.
- Fixed focus distance. Fix at infinity or a mean distance using adhesive tape, but only use one distance for close-ups.
- The image format frame of the camera must be sharply visible on the images and have good contrast.
- The true documents are the original dia-positives, negatives, or digital 'RAW' equivalents. Set camera to use the camera's highest quality format.



2.2 - CAMERA CALIBRATION

Use the best quality, highest resolution and largest format camera available.

- 'Medium' format is better than a small format.
- A larger sensor is better than a smaller one.
- A wide-angle lens is better than a narrow angle for all round photograph. Very wide-angle lenses should be avoided.
- Calibrate the camera with a fixed focus lens and tape it there.
- Standard calibration information is needed for each camera/lens
- combination screen before capture with each lens will help.
- A standardized color chart should be used in each sequence of frames.



2.3- IMAGE EXPOSURE

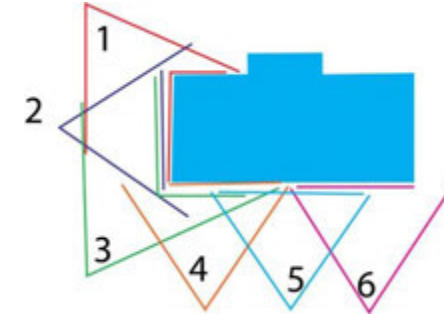
Consistent exposure and coverage is required.

- Work with consistent illumination: beware deep dark shadows.
- Use a lighting rig.
- Use HDR to capture difficult, unbalanced exposures.
- Plan for the best time of the day.
- Use a tripod and cable release/remote control to avoid camera movement and get sharp images.
- Use a panoramic tripod head to get parallax-free panoramic imagery.
- Use the right mode: BW is best for tracing detail but color is good for recording material type and pigment.
- Use RAW or 'high quality' and 'high sensitivity' setting on digital cameras.
- Geotag the images. (pose or EO)

3.3 - THE PROCEDURAL RULES

3.1- RECORD PHOTO LAYOUT

- The ground plan with the direction of north indicated
- The elevations of each facade (at an appropriate scale 1:50, 1:100 - 1:500).
- Photo locations and directions (with frame numbers).
- Single photo coverage and stereo coverage.
- Control point locations, distances and plumb-lines.
- If using 'natural (photo)' points a clear diagram showing each point is required.



3.2 - LOG THE METADATA Make witnessing diagrams of:

- Site name, location and geo-reference,
- Owner's name and address.
- Date, weather and personnel.
- Client commissioning body, artists, architects, permissions, obligations, etc.
- Cameras and optics, focus and distance settings.
- Calibration report, including the geometric and radiometric results if available.
- Description of place, site, history, bibliography, etc.
- Remember to document the process as you go.

3.3 - ARCHIVE Include the following:

- Data must be complete, stable, safe and accessible:
- Check completeness and correctness before leaving the site.
- Save images to a reliable location off the camera.
- Save RAW formats and TIFF copies.
- Remember a DVD is not forever !
- Write down everything immediately
- The original negatives/dia-positives/RAW files are archive documents.
- Treat and keep them carefully.
- Don't cut into the format if cutting the original film. If using digital cameras,
- don't crop any of the images and use the full format.
- Ensure the original and copies of the control data, site diagrams and
- images are kept together, as a set, at separate sites on different media.

Earthworks Survey



Ground Control Points

**For Affine Transforms
3 or More GCPs laid out in grid
pattern is optimum.**



PID,N,E,Z LL WGS84

6,30.436890915195502,-84.274244734871402,30.942

5,30.436893077778482,-84.274259106846131,30.956

4,30.436916750462579,-84.274281393718539,30.949

3,30.436910789491982,-84.274240358683386,30.964

2,30.437032422138138,-84.274233011989523,31.553

1,30.437036319796153,-84.274207122513403,30.994

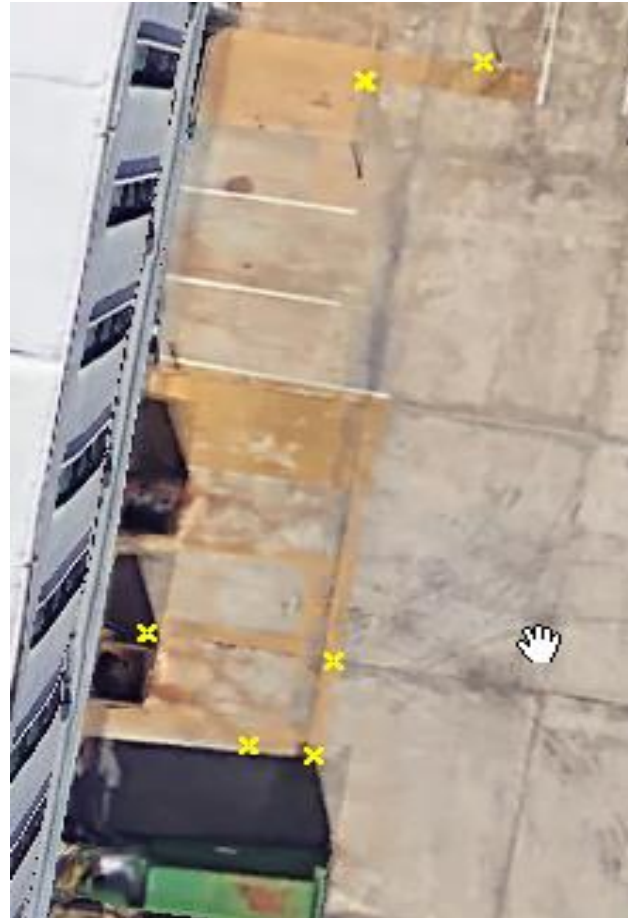
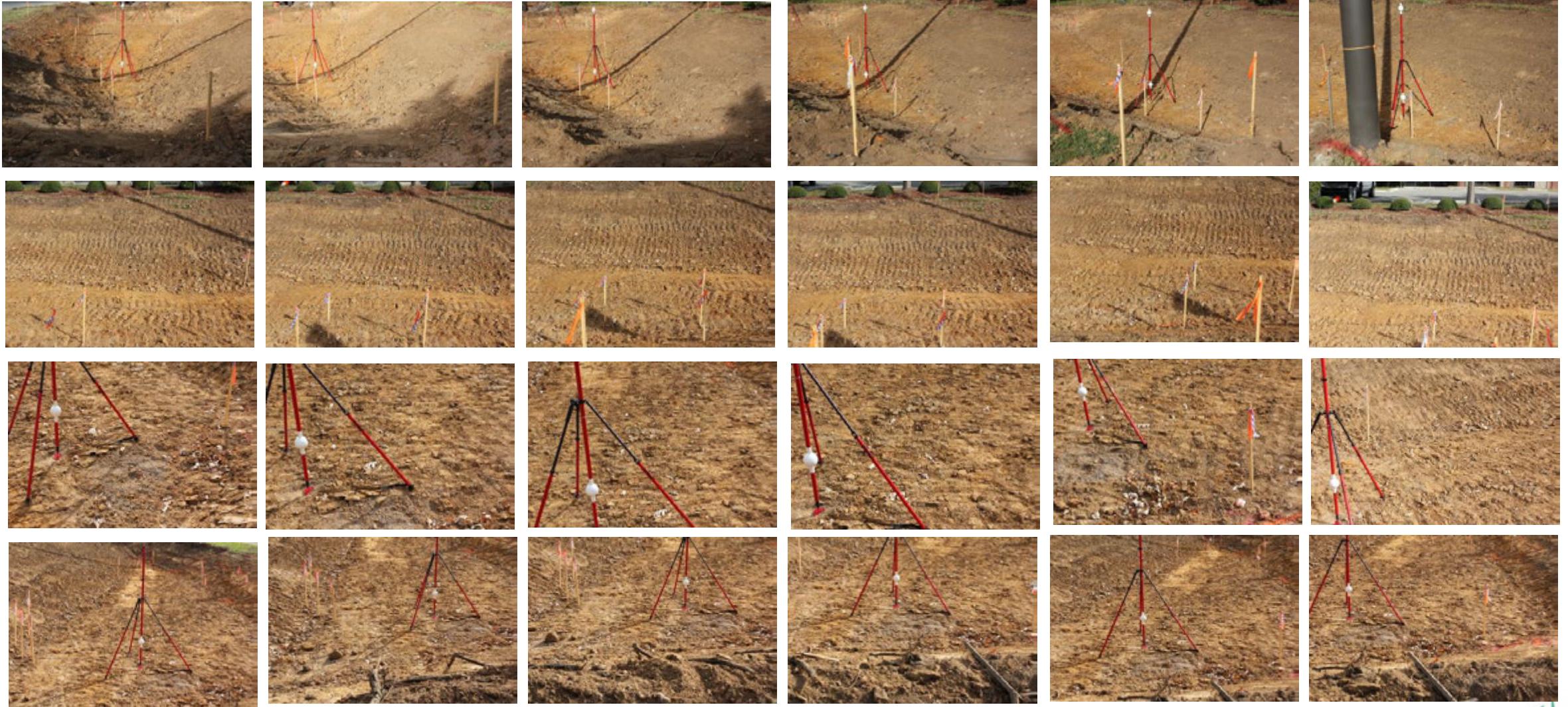
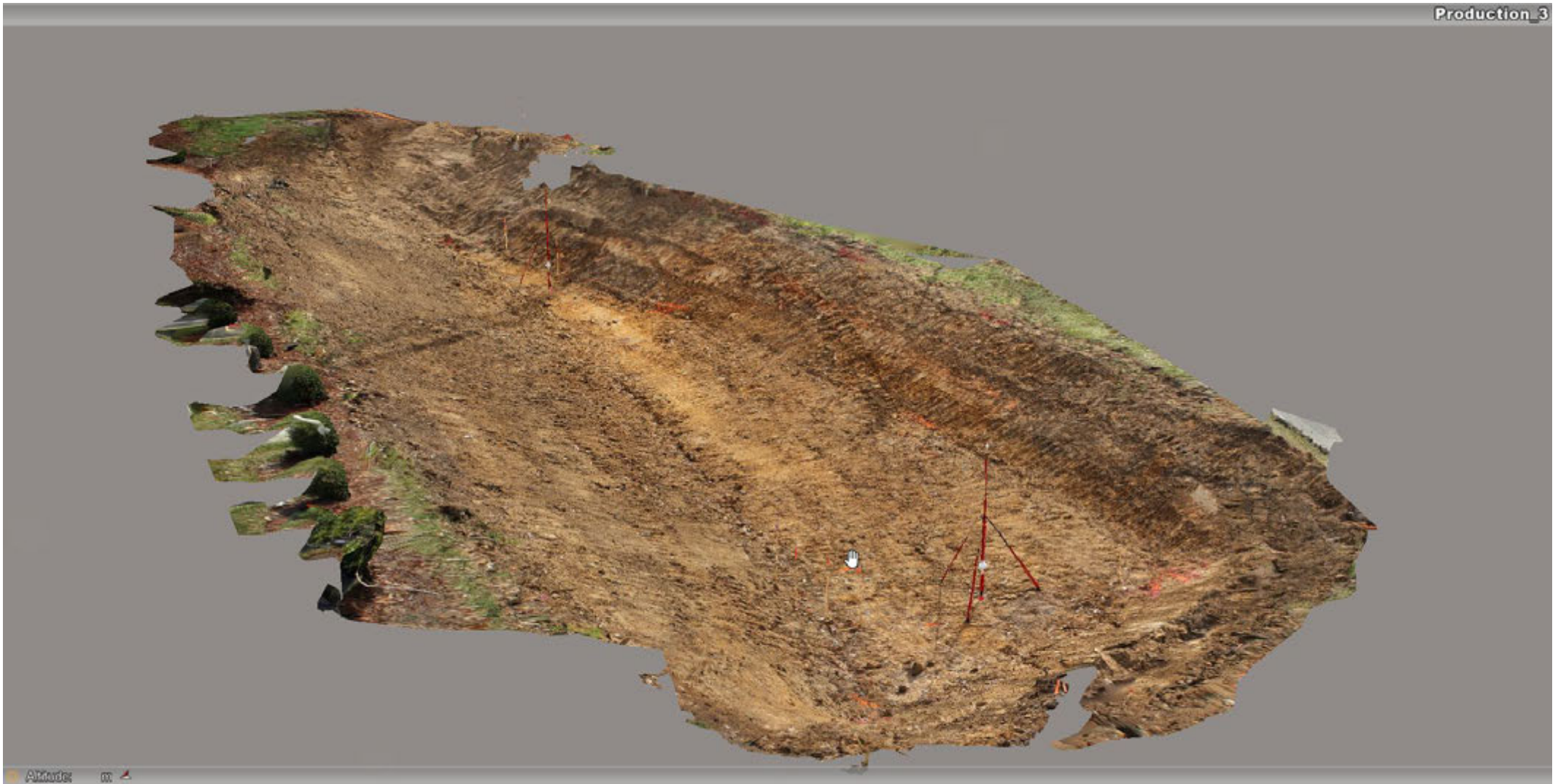


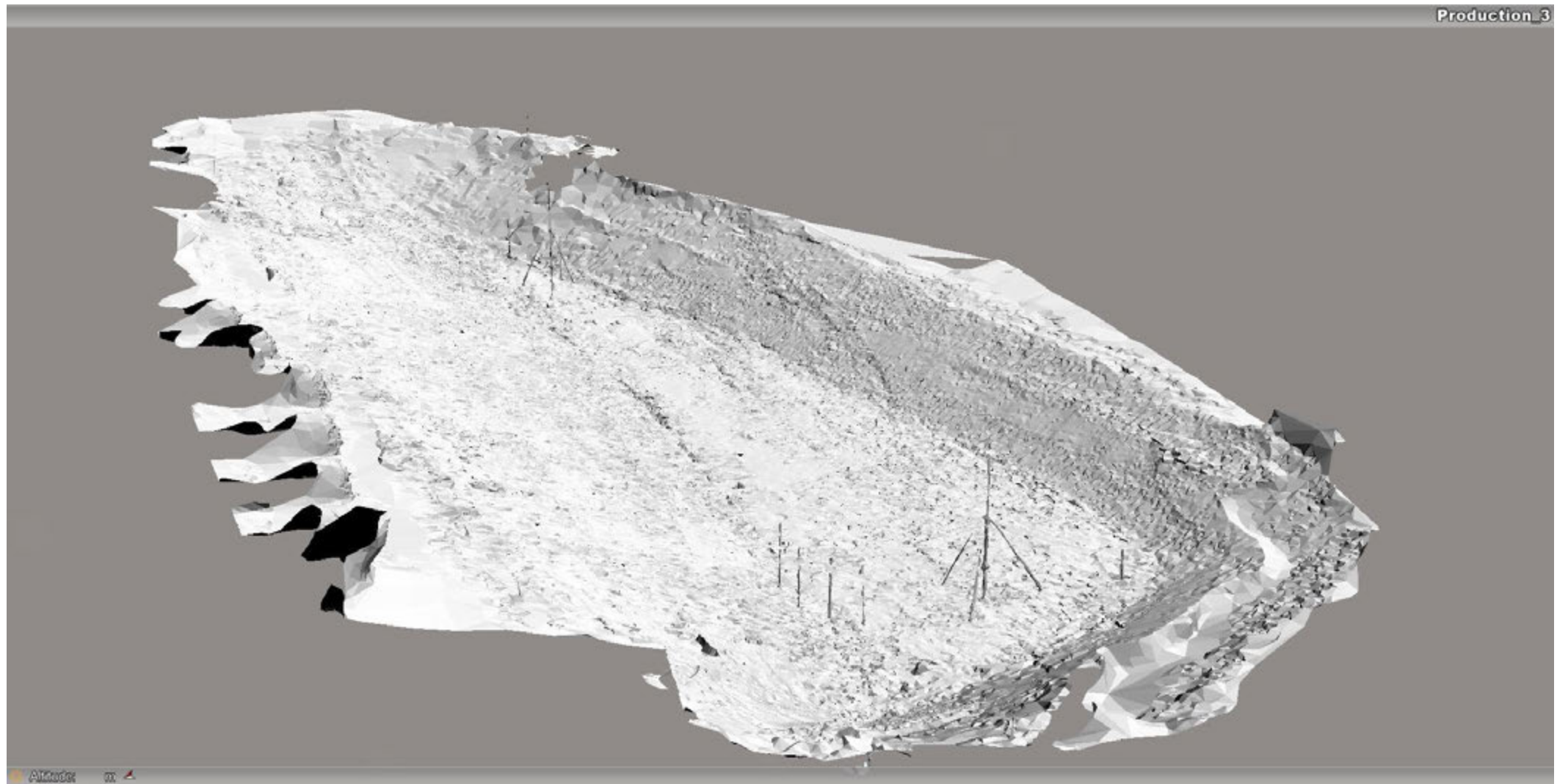
Image Capture



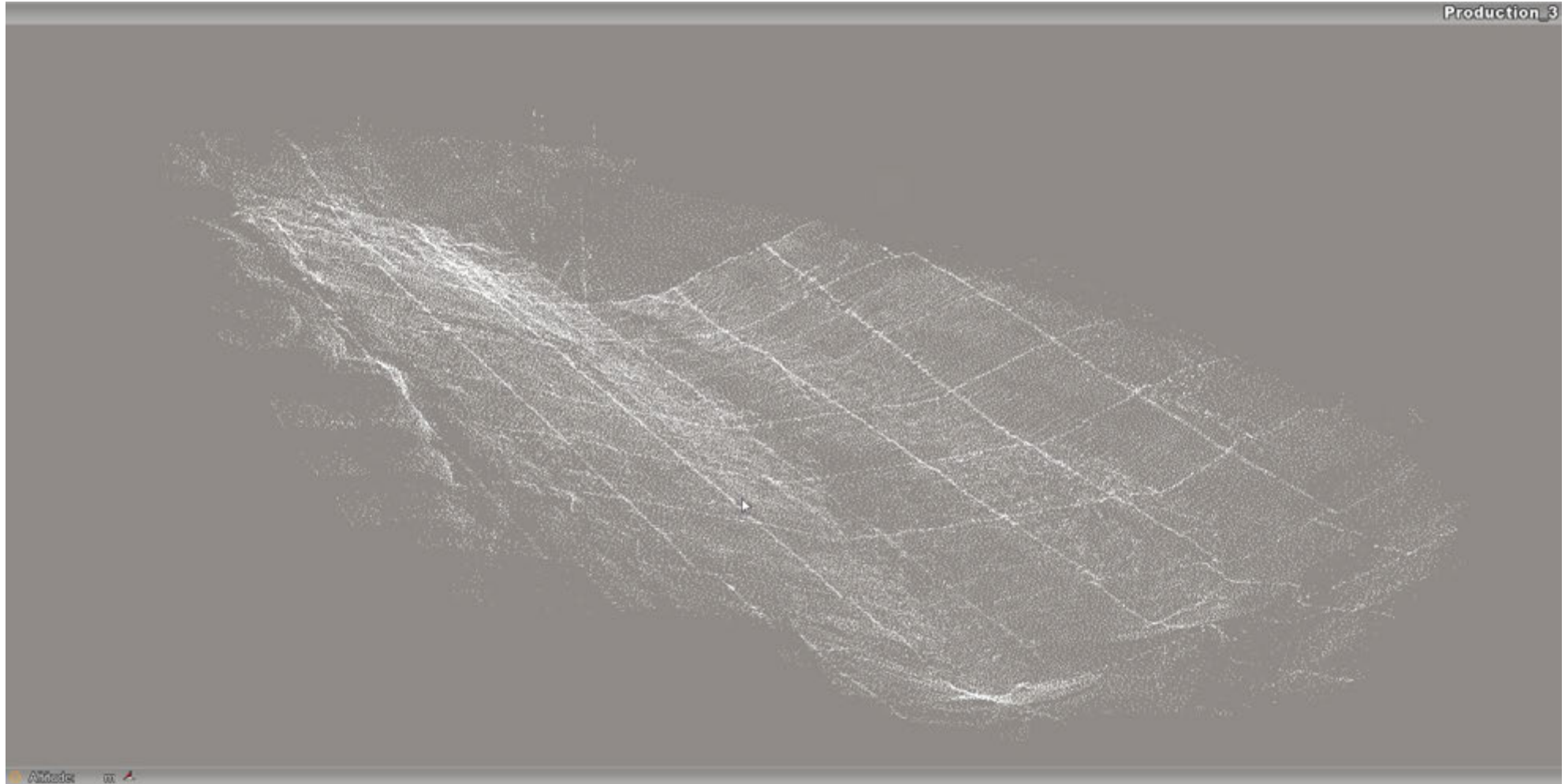
Multi-ray MODEL



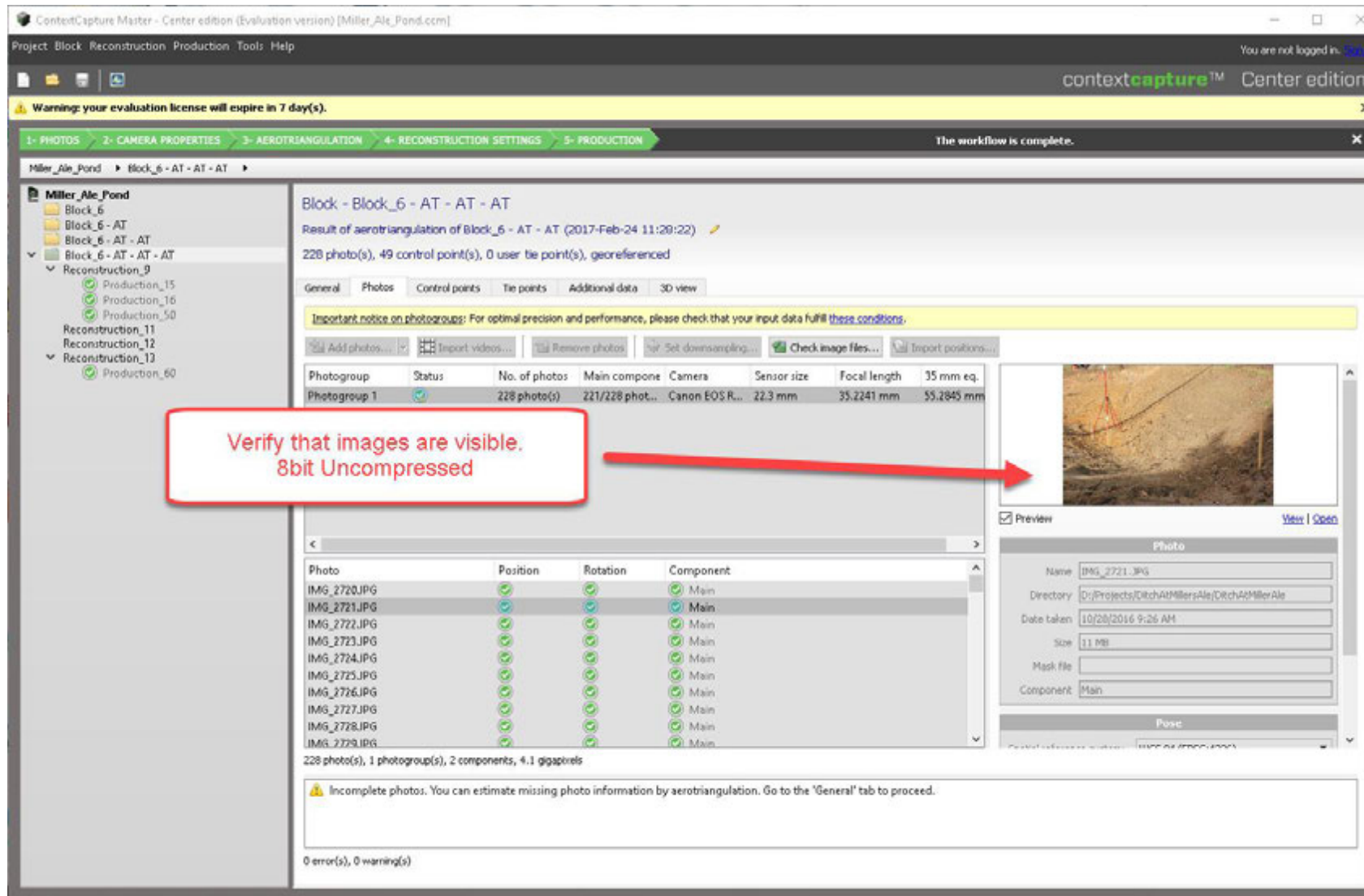
WIREFRAME MODEL



DSM Point Cloud



Context Capture TIPS for TIFF 8bit uncompressed



- JPEG
- Tag Image File Format (TIFF)
- Panasonic RAW (RW2)
- Canon RAW (CRW, CR2)
- Nikon RAW (NEF)
- Sony RAW (ARW)
- Hasselblad (3FR)
- Adobe Digital Negative (DNG)
- Audio Video Interleave (AVI)
- MPEG-1/MPEG-2 (MPG)
- MPEG-4 (MP4)
- Windows Media Video (WMV)
- Quicktime (MOV)

Good Quality and Location of Ground Control Points (GCP)

Control points editor (Read only)

File Actions

Control points

Spatial Reference System (SRS): WGS 84

Name	Category	Check point	Given Longitude	Given Latitude	Given Ellipsoidal height	Horizontal accuracy [m]	Vertical accuracy [m]	Estimated Longitude	Estimated Latitude	Estimated Ellipsoidal height	RMS of reproj. error [pix]	RMS of dist. to rays [m]	3D error [m]	3D horizontal error [m]	3D vertical error [m]
02	Full	<input type="checkbox"/>	-84.2725565	30.4383263	33.997	0.010	0.010	-84.2725565	30.4383263	34.007	6.45	0.006	0.007	0.007	0.006
03	Full	<input type="checkbox"/>	-84.2723961	30.4383392	34.020	0.010	0.010	-84.2723962	30.4383396	33.992	50.76	0.046	0.057	0.049	-0.028
04	Full	<input type="checkbox"/>	-84.2723771	30.4383415	33.976	0.010	0.010	-84.2723771	30.4383412	34.007	41.11	0.038	0.027	0.020	0.021
DOC10	Full	<input checked="" type="checkbox"/>	-84.2723120	30.4383681	35.528	0.010	0.010								
DOC11	Full	<input checked="" type="checkbox"/>	-84.2723392	30.4383961	35.604	0.010	0.010								
DOC12	Full	<input checked="" type="checkbox"/>	-84.2723797	30.4383942	35.756	0.010	0.010								
DOC13	Full	<input checked="" type="checkbox"/>	-84.2724483	30.4383920	35.671	0.010	0.010								
DOC14	Full	<input checked="" type="checkbox"/>	-84.2725189	30.4383881	35.573	0.010	0.010								
DOC15	Full	<input checked="" type="checkbox"/>	-84.2725902	30.4383802	35.195	0.010	0.010								
DOC16	Full	<input checked="" type="checkbox"/>	-84.2726092	30.4383721	35.150	0.010	0.010								


Photos

Display photos: That night view point

Display points: All

Display hints: Yes

IMG_2768 IMG_2769 IMG_2770 IMG_2771 IMG_2772 IMG_2773 IMG_2774 IMG_2775 IMG_2776



Zoom: wheel ; ctrl ; +/- ; 0 | Move viewing area: click and drag | Hide hints/points: shift | Quality=original

Measurements

Measurements:

Image	x	y	Reproj. error [pix]	Distance to ray [m]
...chAtHllozAtle/	1433.74	2460.30	5.68	0.004
...chAtHllozAtle/	1710.86	1714.06	5.55	0.004
...chAtHllozAtle/	1679.50	2739.98	5.54	0.004
...chAtHllozAtle/	2254.22	1443.34	5.79	0.004
...chAtHllozAtle/	1958.54	2309.26	5.65	0.004
...chAtHllozAtle/	839.18	1728.78	5.80	0.004
...chAtHllozAtle/	3271.18	1476.62	5.44	0.004
...chAtHllozAtle/	2739.98	2596.62	5.27	0.004

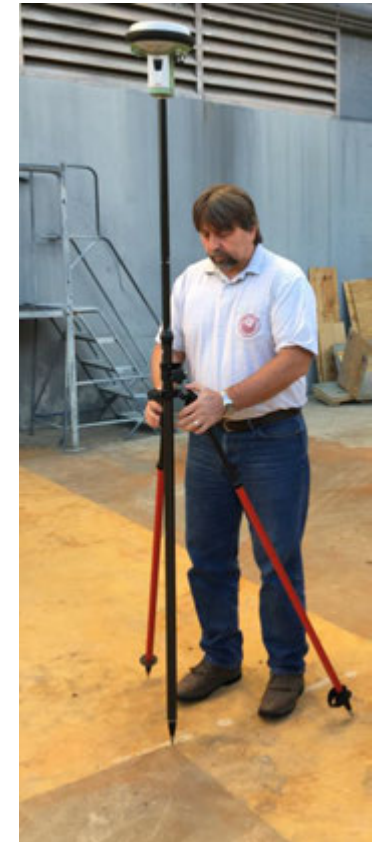
Statistics

All control points:

- number of points: 49
- RMS of reproj. error: 37.90 pix
- RMS of dist. to rays: 0.034 m
- RMS of 3D error: 0.039 m
- RMS of 3D horizontal error: 0.031 m
- RMS of 3D vertical error: 0.024 m

Current photo:

- number of usable measurements: 1
- RMS of reproj. error: 5.44 pix
- RMS of dist. to rays: 0.004 m



Coordinate System LL WGS 84

Control points editor (Read only)

File Actions

Control points

Spatial Reference System (SRS): WGS 84

Name	Category	Check point	Given Longitude	Given Latitude	Given Ellipsoidal height	Horizontal accuracy [m]	Vertical accuracy [m]	Estimated Longitude	Estimated Latitude	Estimated Ellipsoidal height	RMS of reproj. error [px]	RMS of dist. to rays [m]	3D error [m]	3D horizontal error [m]	3D vertical error [m]
02	Full	<input type="checkbox"/>	-84.2725565	30.4383263	33.997	0.010	0.010	-84.2725565	30.4383263	33.997	6.45	0.006	0.007	0.003	0.006
03	Full	<input type="checkbox"/>	-84.2723961	30.4383392	34.020	0.010	0.010				50.76	0.046	0.057	0.049	-0.028
04	Full	<input type="checkbox"/>	-84.2723731	30.4383415	33.976	0.010	0.010				47.71	0.038	0.037	0.020	0.031
D0C10	Full	<input checked="" type="checkbox"/>	-84.2723120	30.4383681	35.528	0.010	0.010								
D0C11	Full	<input checked="" type="checkbox"/>	-84.2723392	30.4383861	35.604	0.010	0.010								
D0C12	Full	<input checked="" type="checkbox"/>	-84.2723797	30.4383942	35.756	0.010	0.010								
D0C13	Full	<input checked="" type="checkbox"/>	-84.2724483	30.4383920	35.671	0.010	0.010								
D0C14	Full	<input checked="" type="checkbox"/>	-84.2725189	30.4383881	35.573	0.010	0.010								
D0C15	Full	<input checked="" type="checkbox"/>	-84.2725902	30.4383802	35.195	0.010	0.010								
D0C16	Full	<input checked="" type="checkbox"/>	-84.2726092	30.4383721	35.150	0.010	0.010								

Control coordinates Lat/Lon WGS 84

Photos

Display photos: All Display points: All Display hints: Yes

IMG_2720 IMG_2721 IMG_2722 IMG_2723 IMG_2724 IMG_2725 IMG_2726 IMG_2727 IMG_2728

Measurements

Measurements:

Image	x	y	Reproj. error [px]	Distance to ray [m]
-------	---	---	--------------------	---------------------

Statistics

All control points:

- number of points: 49
- RMS of reproj. error: 37.90 px
- RMS of dist. to rays: 0.034 m
- RMS of 3D error: 0.039 m
- RMS of 3D horizontal error: 0.031 m
- RMS of 3D vertical error: 0.024 m

Current photo:

- number of usable measurements: 2
- RMS of reproj. error: 26.15 px
- RMS of dist. to rays: 0.033 m

Zoom: wheel; ctrl; +; -; 0 | Move viewing area: click and drag | Hide hints/points: shift | Quality=original

GPS tags, if present in Exif metadata or in an accompanying XMP file, are automatically extracted, and can be used to georeference the generated 3D model.

Incomplete GPS tags are ignored (with latitude and longitude coordinates but without altitude).

GPS altitude reference *Sea level* and *WGS 84 ellipsoid* are supported.

Set Data Tile Size to Maximize Processing Efficiency

ContextCapture Master - Center edition (Evaluation version) [Miller_Ale_Pond.ccm]

Project Block Reconstruction Production Tools Help

You are not logged in. [Login](#)

contextcapture™ Center edition

Warning: your evaluation license will expire in 7 day(s).

1- PHOTOS 2- CAMERA PROPERTIES 3- ARROTRIANGULATION 4- RECONSTRUCTION SETTINGS 5- PRODUCTION

The workflow is complete.

Miller_Ale_Pond > Block_6 - AT - AT - AT > Reconstruction_9

Miller_Ale_Pond

- Block_6
 - Block_6 - AT
 - Block_6 - AT - AT
 - Block_6 - AT - AT - AT
 - Reconstruction_9
 - Production_15
 - Production_16
 - Production_50
 - Reconstruction_11
 - Reconstruction_12
 - Reconstruction_13
 - Production_60

Reconstruction - Reconstruction_9

enter your description here

Regular planar grid (grid size 10 meters), 8 tile(s), high precision

General Spatial framework Reconstruction constraints Reference 3D model Processing settings

Spatial Reference System (SRS)

Spatial reference system: NAD83 / Florida North (HUS) (EPSG:2238)

Region of interest

Bounding box:

X (meters): min 621840.350000 max 621871.260000

Y (meters): min 159451.560000 max 159467.890000

Z (meters): min 33.000000 max 36.120000

Dimensions: 30.91 meters x 16.29 meters x 3.12 meters

Import from XML...

Reset bounds...

Tiling

Mode: Regular planar grid Divide reconstruction into square tiles along the XY plane.

Options

Tile size: 10 meters

Please adjust the tile size so that the expected maximum RAM usage is suitable for your configuration.

☒ Discard empty tiles

Overview

The tiling contains 8 tile(s)

Expected maximum RAM usage for a job: 15 GB

Altitude: 111m

Data tiled to maximize processing efficiency.

Hardware Requirements for Context Capture

An Adequate graphics card that supports CUDA is very important !

- **CUDA Zone**

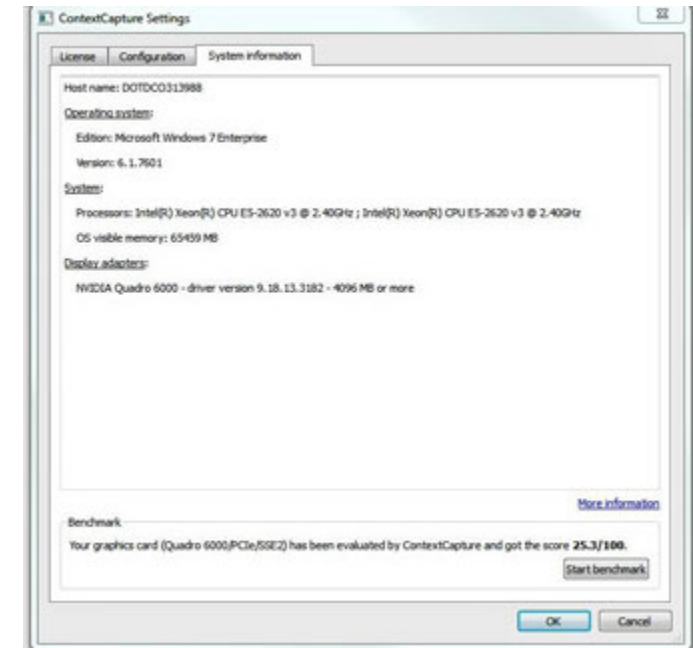
<https://developer.nvidia.com/cuda-zone>

CUDA® is a parallel computing platform and programming model invented by NVIDIA

- http://www.nvidia.com/object/imaging_comp_vision.html



GRAPHICS FEATURES	17.3" PLATFORM					15.6" PLATFORM		
	Quadro M5500	Quadro M5000M	Quadro M4000M	Quadro M3000M	Quadro M2000M	Quadro M1000M	Quadro M600M	Quadro M500M
CPU/Mobile Platform Generation	Skylake	Skylake	Skylake	Skylake	Skylake	Skylake	Skylake	Skylake
NVIDIA® CUDA® Parallel Processor Cores	2048	1,536	1,280	1,024	640	512	384	384
Memory Size	8GB	8GB	4GB	4GB	4GB	2GB/4GB	2GB	2GB



**Processor: 2 - Intel
Xeon®CPU E5-2620v3
@ 2.4GHz – 64G RAM
NVIDIA Quadro 6000 4G (GPU)**

Performance

ContextCapture exploits the power of general purpose computation on graphics processing units (GPGPU), yielding 50-times faster processing for some operations (image interpolation, rasterization, z-buffering). It also uses multi-core computing to speed up some CPU-intensive parts of the algorithms.

ContextCapture can process 10 to 20 gigapixels per day and per ContextCapture Engine on average, depending on the hardware configuration, for the production of a textured 3D mesh with *Highest* precision.

You can dramatically reduce processing time with grid computing, simply by running multiple ContextCapture engines on several computers, and associate them to a same job queue.

Example: for vertical + 4-oblique aerial datasets with a ground resolution of 10-15 cm and a typical overlap, we have observed an average production rate of 30-50 km² per day on a cluster of 4 ContextCapture Engines.

Regarding memory use, one ContextCapture Engine with 8 GB of RAM can handle up to 1 gigapixel of input data and 10 million output triangles in one job.



Closing.....Questions?



<http://www.fdot.gov/geospatial/>

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[Horizontal & Vertical](#)
[Control](#)
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Welcome

Our office leads statewide surveying and mapping efforts through spatial technology expertise in support of Florida's transportation system. We support surveying and mapping activities statewide by providing policies, procedures, guidelines, and training. Our areas of expertise include: Aerial Surveying and Mapping, Location Surveying, Right of Way Mapping, and Geographic Mapping which includes distributing aerial photography, producing the Florida Official Transportation Map, and providing Geographic Information Systems (GIS) support for engineering and operations.

News

Surveying and Mapping (UAS)

An unmanned aircraft system (UAS) is an unmanned aircraft (UA) with associated support equipment, control station, data links, telemetry, communications, and navigation equipment necessary for operations. UA is considered an aircraft under both 49 U.S.C. § 40102 and 14 C.F.R. § 1.1. The potential uses of UAS range from infrastructure inspections, surveillance of crops, and aerial mapping to package delivery and event videography. With the lowering costs of UAS, the growth of many companies are looking to take advantage of this newly available technology.

Posted: May 25, 2016